COAL AGE

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Power Plant Economy and Conservation of Coal

OF late the question of natural resources and their conservation has had much attention and has been the subject of scientific and congressional investigation, and, to some extent, legislation.

One great natural resource, coal, can be conserved to the extent of utilizing what is now a waste product of mining operations, and be thus made to accrue to the immediate financial benefit of the mine owner.

As there is no cheaper fuel at the mine than its product—coal—in the average mine boiler plant, little attention has been given to securing the maximum production of power from the coal used. The cheapness of the fuel has apparently made it unnecessary to go to any expense to insure proper combustion.

Consider the waste products of anthracite mines—culm — silt — washery refuse, etc., having a good heat content, but no market value—of bituminous mines, refuse with 25 to 35 per cent. ash and slate; plenty of heat units, but again an unsalable product.

Many anthracite mines are burning the smaller sizes of buckwheat in their boiler plants and piling up immense heaps of waste, just as bituminous developments are burning run-of-mine and slack and piling up refuse banks. With the exception of a few large operations it has been, and is still, the practice to use a marketable coal hand-fired by cheap labor.

Some of the large anthracite producers have modernized their power plants by installing large boiler units, fired with mechanical stokers, by means of which culm or silt can be economically burned. This releases for the market the coal formerly consumed. The same stoker has created a demand for the size of fuel employed, so that contracts are now being made for the shipment of what is commercially known as No. 3 and No. 4 buckwheat.

By the use of stokers and conveying machinery for coal and ashes, there is also a great saving in non-productive labor. Although some large bituminous producers have installed modern equipment and are utilizing refuse, the possibilities have hardly been touched, as millions of tons of this material are thrown away annually. Each mine probably disposes of more than enough to operate its own power plant.

To burn a low-grade fuel containing 25 to 35 per cent. of ash, by hand-firing, is difficult, if not impracticable. Only by the use of mechanical stokers and conveying machinery can it be utilized to advantage.

With a properly-designed equipment of boilers and stokers, with forced draft, together with coal and ash conveying machinery, it is possible to operate boilers considerably in excess of their rated capacity with refuse of this character; and at the same time the labor cost per ton of fuel fired is greatly reduced.

Coal that was formerly used at the mine will then be available for market.

The cost of refuse as fuel may be taken as the fixed charges, maintenance and operating expense on the stokers and conveying machinery, plus the boiler room labor. Comparing this cost with that of using a salable fuel charged against the boiler plant at the market value, plus boiler room labor, it will be seen that the net saving is a large one which cannot well be overlooked.

The difference would pay for the stokers and conveying machinery in a short time.

This general proposition applies to both anthracite and bituminous operations. Each plant, however, presents its own peculiar problems.

If these are intelligently studied, the proper selection of equipment cannot but result in large savings in operating costs and an increased production of marketable coal.

—By John Van Brunt.

Generating Stations and Some Features Governing Their Design

By E. A. Lof*

SYNOPSIS—Modern power stations are of three distinct varieties according to the working fluid employed—steam, water or gas. Although the prime movers and generators vary radically in these various types the control and transmission apparatus in all three classes of plants are strongly similar.

Electricity is not in itself a primary source of energy. To become available for conversion into electric power, the forces found in nature must first be converted into mechanical energy by some form of prime mover. In all practical cases electric current is again transformed before being utilized. Electricity is therefore the most convenient form in which, for many purposes, energy may be transmitted and distributed.

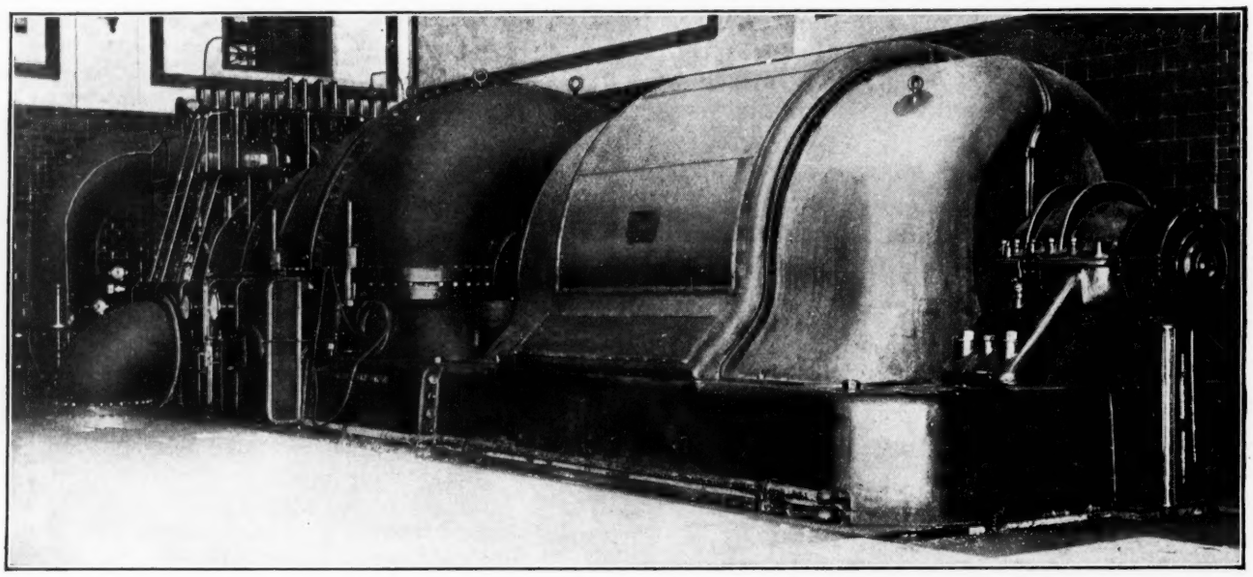
It is needless to dwell upon the enormous increase that has taken place in the use of electric power during the past 10 or 15 years. The rapid advance is best illustrated by a reference to the accompanying curves, which are self-explanatory. For the generation of this power, the steam turbine and the waterwheel stand foremost, and it is an astonishing rate at which the size, as well as the efficiency of these prime movers, has increased of late. A single-unit 35,000-kw. steam turbo-generator is now under construction and there is every reason to believe that the 50,000-kw. mark will be passed in the not very distant future.

Comparing the above unit with those of 10 years ago it is interesting to note that the over-all efficiency has been increased something like 20 per cent. while the weight per kilowatt has been reduced more than half.

Similarly with waterwheels and internal-combustion engines, the former are now being built in sizes of 17,500 kw., and while an active development of the latter took place a few years ago in connection with the steel industry, their use during recent years has mainly been confined to small and medium-sized isolated plants.

This marked increase in the efficiency of prime movers and electric apparatus, besides the equally pronounced decrease in their cost, has made it possible even for the smallest town to support its own electric lighting plant. The introduction of extensive transmission and distributing systems has, on the other hand, still further lowered the cost of power and makes possible the supply of very small quantities throughout rural districts.

There is at present a strong tendency to connect together two or more plants or systems with a view of interchanging power as conditions require. The result is necessarily increased reliability and improved service conditions. The consolidation of a number of properties under one management and the concentration of a large number of small power plants in one or more large ones have had a marked effect in reducing the cost of electric energy.



A 30,000-Kw. Horizontal Steam Turbine and Generator

There are numerous advantages in such consolidation. The first cost per kilowatt of the large units entering into the construction of a big plant is lower than that of the small units entering into a small plant. The initial expenditure necessary for a given service is therefore reduced as is also the annual fixed charge thereon. A large plant can obviously be operated more economically than a small one. It can afford to maintain a more efficient engineering staff and take advantage of economies which would be out of the question in a small plant.

Another advantage of the large central station lies in serving a diversified load, since one kilowatt capacity

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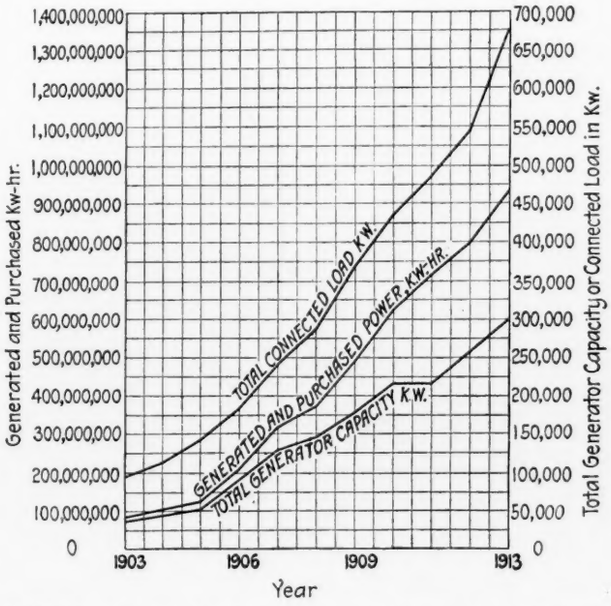
of such a station is equivalent to considerably more than one kilowatt if each part of the combined load were to be served separately.

Admirable examples of what consolidation can accomplish is found in our public-service corporations and the large central stations in our great cities. Notable among the latter is the Commonwealth Edison Co., of Chicago, the enormous expansion of which is clearly illustrated in the accompanying curves.

The load factor of a plant or system is the ratio of the average to the maximum power during a certain period of time. The average power is taken over a certain interval, such as a day, a month or a year, and the maximum over a short period of the heaviest load within that time. In each case the interval of maximum load and the period over which the average is taken should be definitely specified, such as a "half-hour monthly" load factor, the proper interval and period being usually dependent upon local conditions.

The load factor is therefore in a sense a measure of the extent to which the investment is being utilized, this

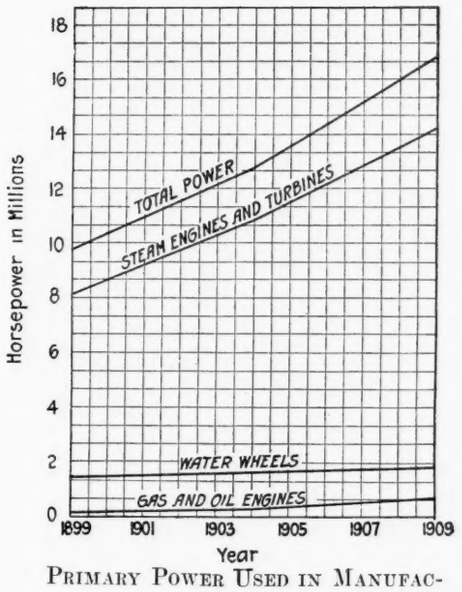

Generated and Purchased Kw-hr.
Total Generator Capacity or Connected Load in Kw.
TOTAL CONNECTED LOAD K.W.
GENERATED AND PURCHASED POWER K.W.-HR.
TOTAL GENERATOR CAPACITY K.W.
Year

Growth of the Commonwealth Edison Co., Chicago

in turn affecting the cost of the power generated. The ideal conditions would obtain if the station could be operated at its rated capacity for the full 24 hours of the day, but this is evidently out of the question and even a close approach thereto is only possible under special conditions, such as for example in electrochemical industries.

The subject of load factor is nowadays given careful study and consideration, and marked improvements have been made in increasing the same by our large central stations by combining lighting, street-railway and industrial loads. Thus the Commonwealth Edison Co. operates with a 44 per cent. load factor, while from 30 to 35 per cent. is the average for central-station service.

Reliability is naturally one of the main considerations in any power-supply undertaking. It follows that the more reliable the service is, the higher will be the charge for power, due to the increased investment in reserve equipment and protective devices.



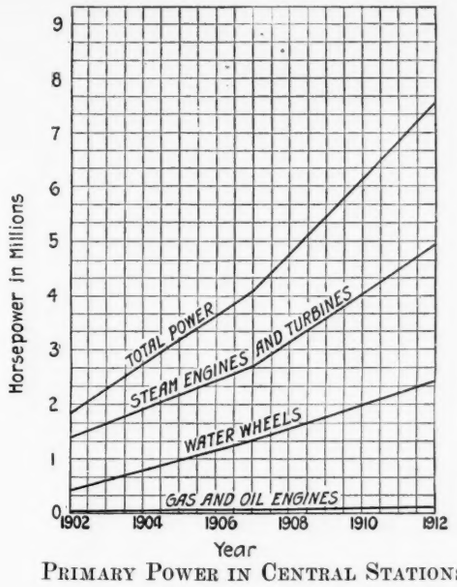
Primary Power Used in Manufacturing Industries

For a steam plant the reserve equipment usually consists of one or more spare units, and while such are also provided in important hydro-electric developments, it is becoming a general practice with the latter to provide auxiliary steam stations.

The function of such stations depends principally upon the hydro-electric development in question, the load and its nature. It may be any one or a combination of the following:

1. To be held as an emergency reserve to take over the load in case of a breakdown in the hydro-electric plant or transmission line.
2. To be held in reserve for periods of low or insufficient water supply.
3. To be held in reserve for peak-load periods.
4. To be operated continuously in conjunction with the hydro-electric plant.

Almost all systems of any importance generate three-phase alternating current on account of its economy and the ease with which it can be transformed and trans-



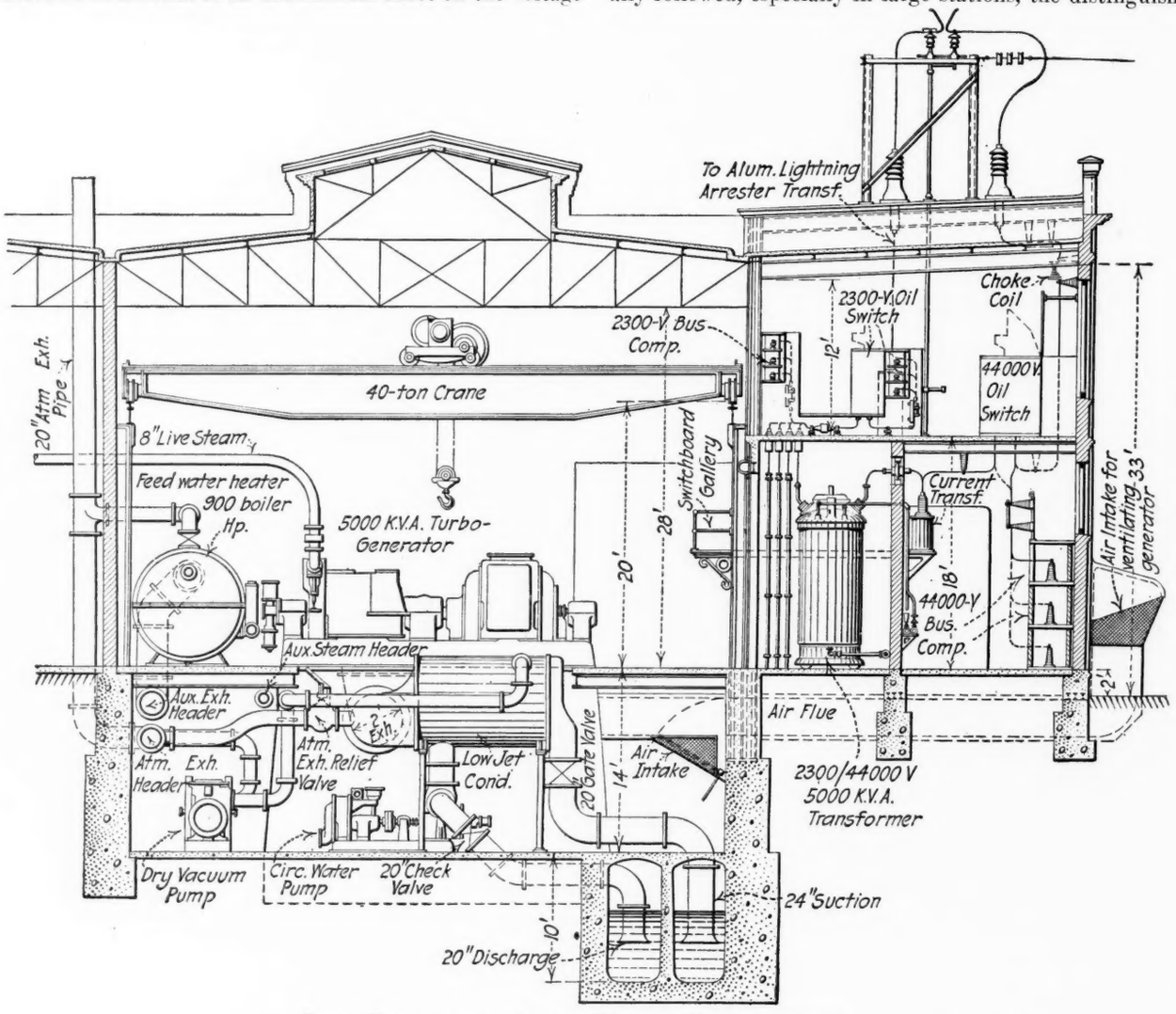
Primary Power in Central Stations

mitted. Should direct current be required, as for example for traction service, it can readily be obtained by means of converters or motor-generator sets.

The standard frequencies in this country are 25 and 60 cycles, the choice depending upon the service and local conditions of the development. Sixty cycles is, of course, preferable as it is better adapted for lighting, and gives many more possible speeds for generators as well as motors. For long transmission lines or extensive underground systems, the 60-cycle frequency may not be permissible on account of its detrimental effect on the voltage

by installing high-voltage generators, power for this load may be directly transmitted at the generator voltage, while step-up transformers may be provided for raising the pressure of the current which is to be transmitted for greater distances.

When arranging the apparatus in any kind of power station, simplicity and reliability of operation should be carefully kept in mind. Provision must also be made for symmetrical extensions to the plant to provide for future requirements. The unit principle of installation is generally followed, especially in large stations, the distinguish-



Cross-Section of a Steam-Turbine Power Station

regulation. Changing over from one frequency to the other or tying together two systems of different frequencies can, however, readily be accomplished by means of frequency changers.

The generator voltage is determined by the nature of the load and the distance of transmission, the standard values ranging from 240 to 13,200 volts. Whether the generators are to be wound for high voltage and direct transmission, or for a lower voltage and used with step-up transformers, is to a certain extent decided by the relative cost of the two methods. If economically feasible the latter method is the more reliable and to be recommended especially for small and medium-sized plants. In other instances the nature of the local load may be such that,

ing feature of which is that the prime movers, generators, transformers, etc., are arranged in separate units or groups, each one of which embodies all the essential features of a complete generating plant, with the great advantage that trouble with any single piece of apparatus is localized and its effect only felt in that unit of which it forms a part.

The boilers may be arranged either in a single or double row facing a firing aisle, running the full length of the station, or there may be several lateral firing aisles, each serving a double row of boilers. Where ground space is valuable, the double-deck feature may be utilized. This, however, requires a heavy building, while on the other hand it complicates operation to a considerable extent

The prime movers and generators are as a rule installed on the main floor in a line parallel with the major axis of the building, and with a sufficient spacing between units to provide for a free passage. With vertical water turbo-generators the turbine proper is located in the basement. This is usually also the case with the condensers in a steam plant. All piping is carried below the main floor, thus avoiding the objectionable appearance of exposed piping.

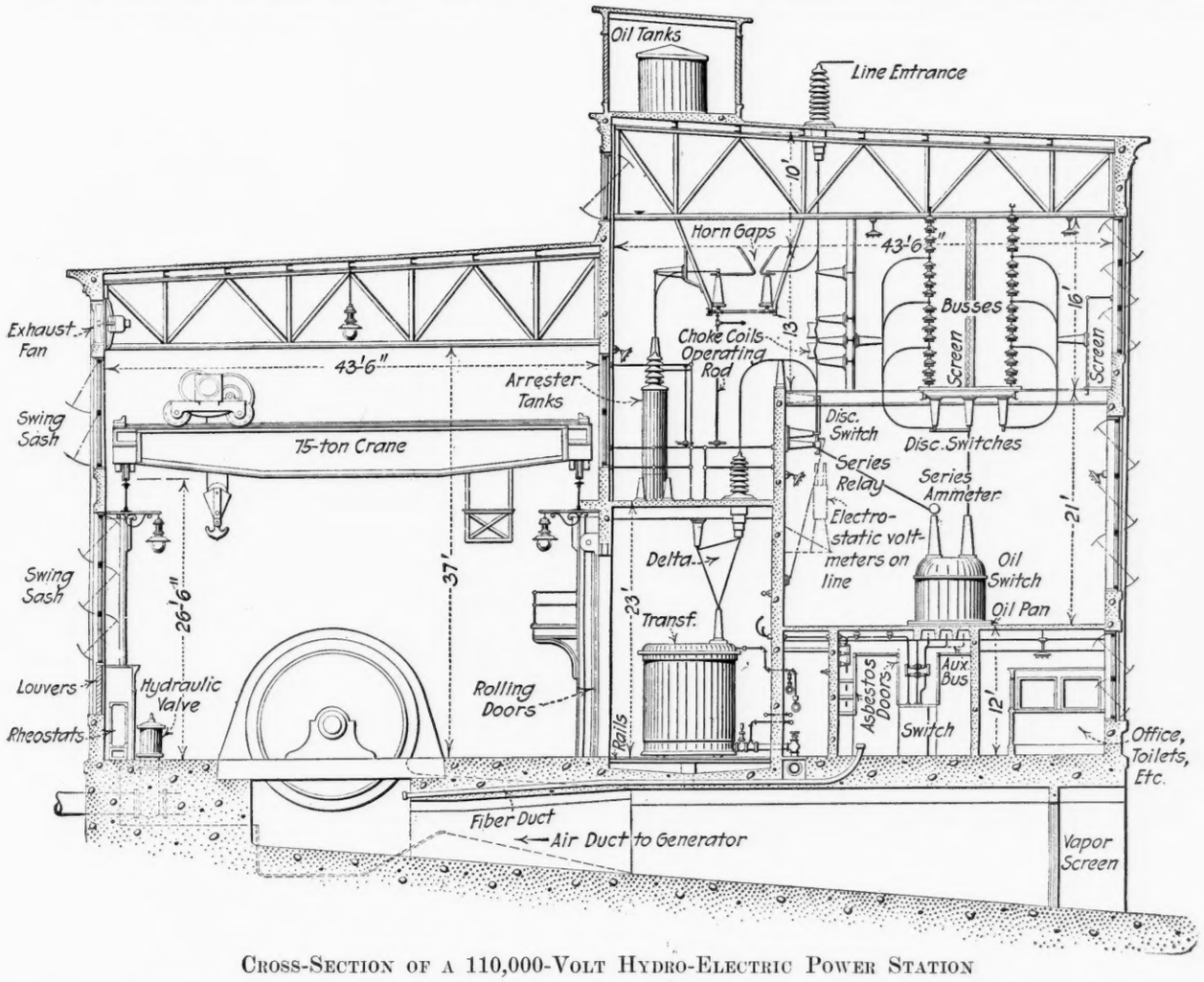
The exciters should be located in the center of the generator room, so as to reduce the field leads to a minimum and simplify the sectionalizing of the system. Where one exciter is furnished for each generator, they should of course be located as closely to their respective units as possible and are often direct-connected to them.

The transformers are mostly placed in compartments on the main floor directly back of the generators, and a track is provided in front of these compartments so that they can be readily removed for repairs.

The busbars and oil switches are located on the various floors of the switch-house, with the control board so situated that an unobstructed view can be obtained of the station. It is difficult to fully describe the complete arrangement of all the apparatus in detail, but a reference to the accompanying cross-sections of two modern steam and hydro-electric power stations will clearly explain the same.

For important installations water-tube boilers are the only kind suitable, their design permitting of high steam pressures and the easy application of superheaters and economizers. There exists quite a difference of opinion as to the sizes which should be used. While in large installations, boilers with a rated capacity of 2400 hp. have been installed and are giving excellent results, there are many engineers who think that a 1200-hp. unit is as large as is desirable. For medium-sized installations, on the other hand, units of from 500 to 600 hp. are generally employed.

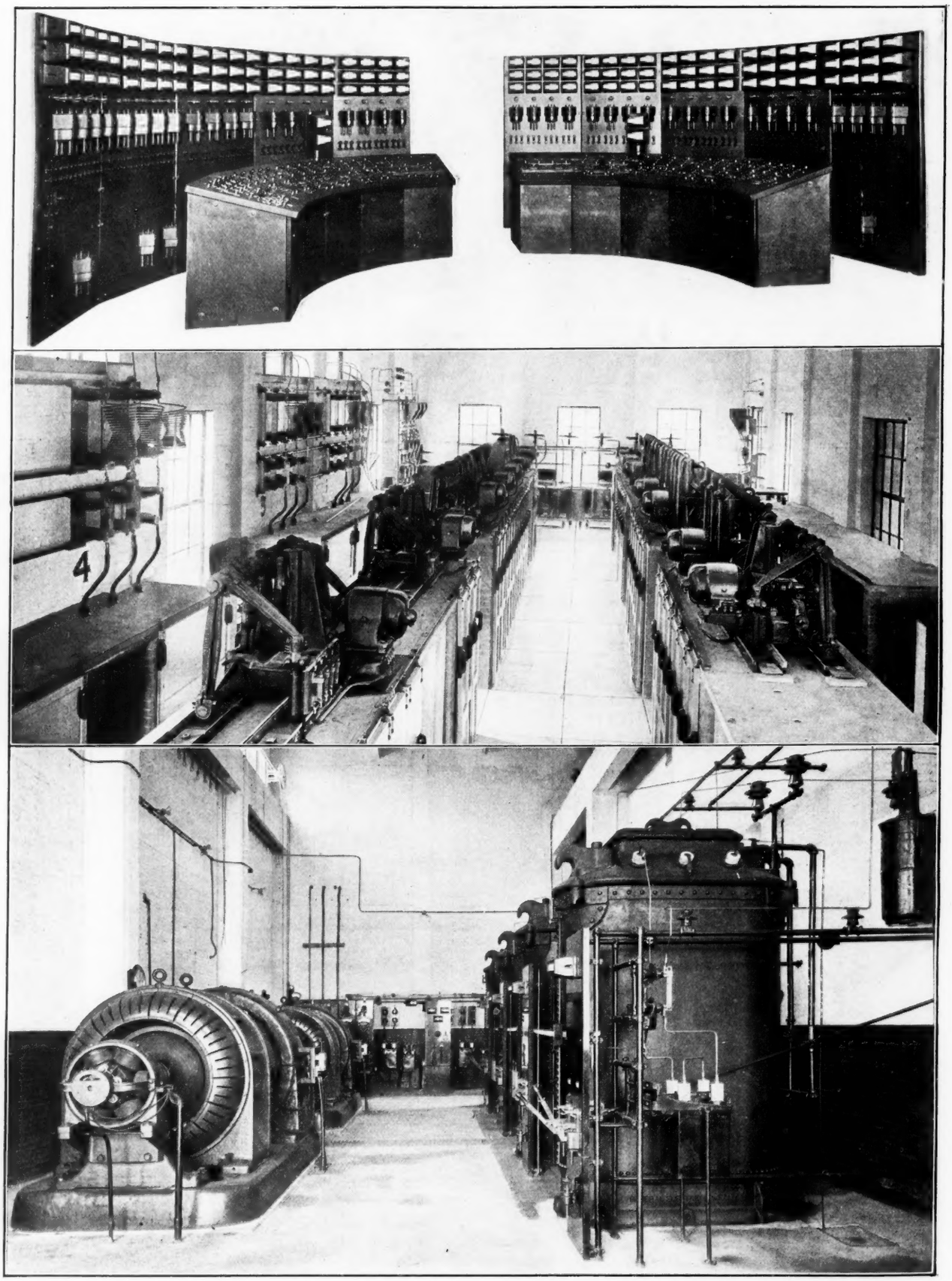
The particular type of prime mover depends, of course, on the working fluid, i.e., whether steam, gas or water.



CROSS-SECTION OF A 110,000-VOLT HYDRO-ELECTRIC POWER STATION

Steam turbines are now almost exclusively used even in sizes below 500 kw., as well as for driving auxiliary apparatus such as feed and condenser pumps, etc. High-pressure condensing units are operating at steam pressures from 150 to 250 lb. and for all installations where efficiency is of great importance superheat is used, this varying from about 125 to 150 deg., the vacuum generally employed ranging from 28 to 29 inches.

Marked improvements have been made in the efficiency of steam turbine installations during the past few years. This has been due not only to improvements in design, but also to a wide use of superheated steam and higher vacuum. A 500-kw. unit, for example, when operating on a steam pressure of 150 lb., 125 deg. of superheat and



A Large Switchboard of the Bench Type, a Number of Motor-Operated Oil Switches in a Substation, and the Interior of a Substation Showing Motor-Generator Sets and Step-Down Transformers

a 28-in. vacuum, has a steam consumption of approximately 17½ lb. per kilowatt-hour, while a 15,000-kw. unit operating at a steam pressure of 250 lb. with 125 deg. of superheat and a 29-in. vacuum, has the remarkably low consumption of only about 11½ lb. per kilowatt-hour.

When internal-combustion engines are used the gas is usually manufactured in producers, although in steel plants it is obtained from the blast furnaces. It is mainly in this industry in which the gas engine has been used to any considerable extent, the units ranging in capacity from 4000 to 6000 hp., the latter size being the largest available.

The Three Kinds of Head

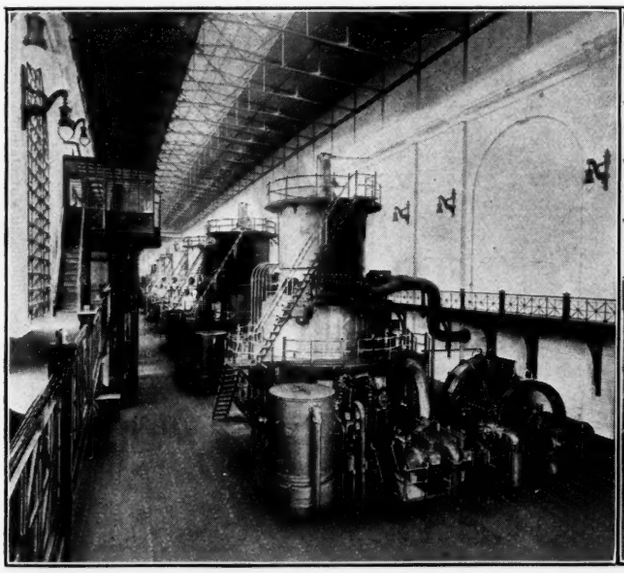
Water-power plants naturally divide themselves into low-, medium- and high-head installations, requiring wheels of entirely different characteristics. Many developments are also subject to a wide variation in water level, and in many low-head installations the back water may bring about a change in the head which is beyond the capacity of one wheel to accommodate, so that in some plants additional wheels must be mounted on the same shaft and cut into service at times of low head.

The reaction type of turbine is generally used for heads from 10 to 600 ft. and the impulse wheel for heads ranging from about 300 to 3000 ft. The proper system is, therefore, well fixed for low and high heads, while for the intermediate range between 300 and 600 ft. the correct type must be determined by comparing the unit speed characteristics.

In determining the proper rating and capacity of the generators for a power station, both this machine and its prime mover must of necessity be treated as a combination so as to secure the highest operating efficiency. With steam engines the point of maximum efficiency is rather marked, and the ratings are usually such that the engine is working under its most economical load at the rating of the electrical generator. With gas engines, however, the efficiency increases with the load beyond the capacity of the machine, and for this reason the rating of such an engine is generally made as nearly as possible to its maximum capacity with only a small margin for regulating purposes. With steam turbines the efficiency curve is almost flat so that it is a question of desirable overload capacity which limits the rating of the turbine. In the waterwheel unit, the efficiency usually falls off rapidly above and below the maximum point, so that the rating of the generator should correspond to the point of maximum efficiency of the wheel.

The number and size of the units are usually indicated by some condition in the proposition. When this is not the case the load factor, the nature of the load, the reserve capacity, the reliability and flexibility of the service should be most carefully considered. For this reason single units are never desirable, except for multiple-plant systems, in which case the necessary reserve can be obtained from other stations.

The effect of the power factor should also be considered when determining the prime mover as well as the generator capacity. Many mistakes have been made in this respect. The generator may, for example, have been designed and rated on the basis of unity power factor operation with a prime mover having a corresponding capacity. After installation it may be found that the actual operating power factor is 0.80, with the result that only 80 per cent. of the prime-mover capacity can be utilized without overloading the generator.



Interior of a Large Steam-Driven Power Station

Interior of a Large Hydro-Electric Power Plant

Most alternating-current generators are wound three-phase with the armature windings connected in star. This is preferable to delta connection, as a smaller number of conductors is required for a given voltage, while on the other hand the danger of the circulation of triple-frequency currents in the closed armature winding is avoided.

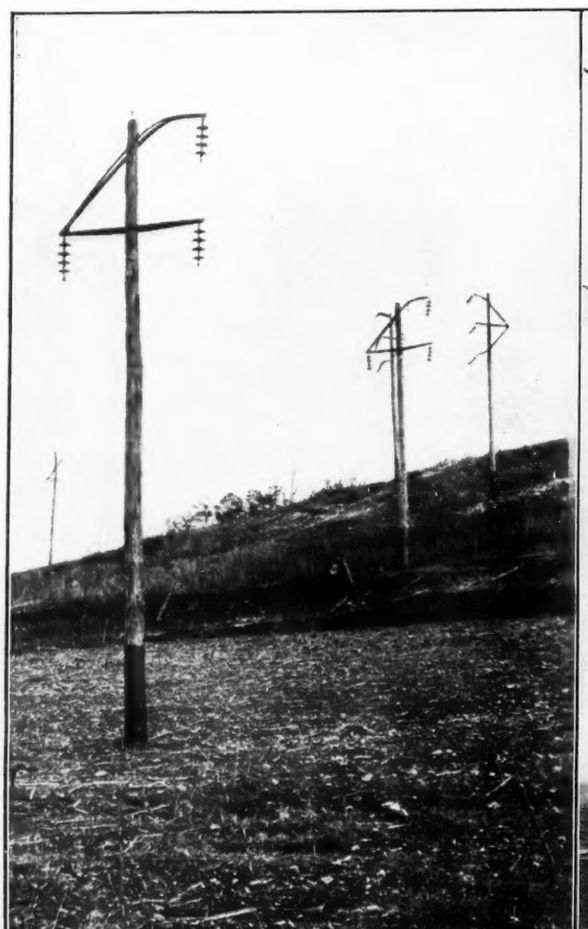
Whether the generator neutral should be grounded or not depends on the operating conditions. If an uninterrupted service is the most essential consideration, the system should not be grounded, while if it is more desirable to limit the voltage stresses, it may be advisable to ground the neutral, thus limiting the stress to the Y-voltage. Grounding may also be advisable where selective action is desired on a number of outgoing feeders, especially underground, so that individual conductors may be disconnected even in the case of grounds.

In transmission systems with one or two lines except for extreme voltages the isolated system seems to be the most favored. The apparatus must therefore be designed to withstand the full delta-voltage. If this is not advisable the neutral must be dead-grounded; but in this case the mechanical design of the apparatus must be such that it can safely withstand the stresses due to frequent short-circuits which occur when grounds take place.

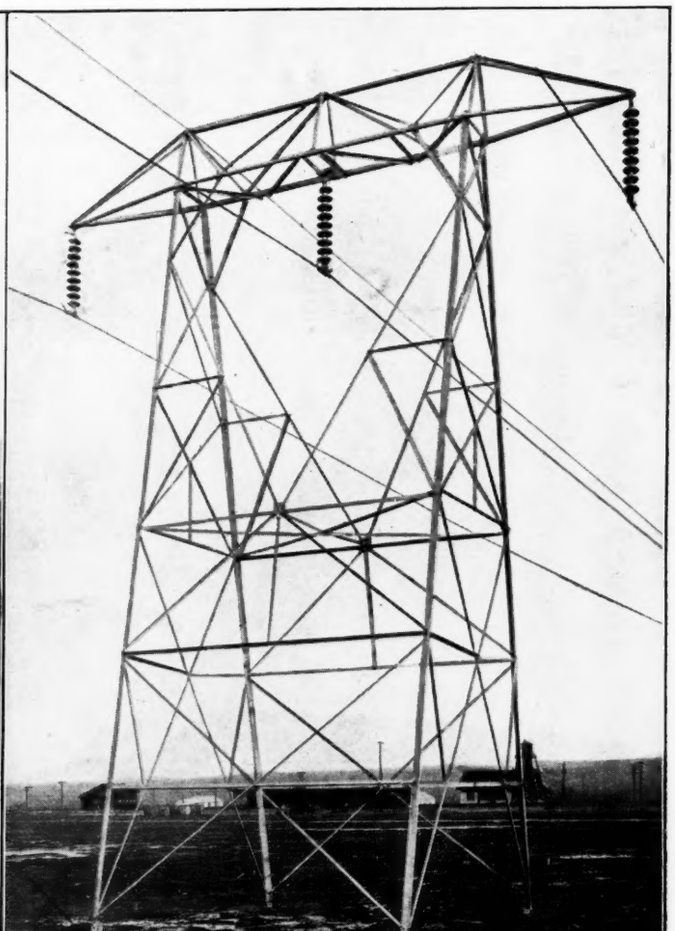
Generators May Be Grounded through Resistance

If the grounding is done to insure selective action of feeders, it may be advisable to ground the generators through a resistance. In this case, however, the voltage owing to the possibilities of a resonance voltage rise.

Close inherent voltage regulation requires a low reactance, which means an expensive machine. This is possibly not as important as the fact that a low-reactance machine, in case of short-circuits, allows a heavy current to flow through the machine and through any other apparatus that may be within the circuit inclosed by the short-circuit. The mechanical stresses set up by these short-circuit currents, which reach enormous values in large concentrated central stations, are liable to severely damage the apparatus, and in order to reduce the currents to safe values large reactances are necessary.



A 66,000-Volt Transmission Line with Wishbone Cross-Arms



Steel Tower on a 15,000-Volt Transmission Line

strain is not limited to the Y-voltage and this must be given due consideration. The resistance should have a value high enough to limit the neutral current, but still low enough to insure that, if a ground occurs in one phase, it will permit a sufficiently large current to flow in the neutral to open the protective circuit-breakers.

Non-inductive resistances are preferable to reactances, since they eliminate the danger of high-frequency oscillations between line and ground through the generator reactance in the path of the third harmonic, by damping the oscillation in resistance. The grounding of the neutral through a resistance may therefore be dangerous,

External Reactances Are Usually Provided

It is not possible to design high-speed turbo-generators for the necessary reactance, and external reactances must usually be provided and inserted in the generator leads or between the bus sections. By so limiting the abnormal flow of current into a short-circuit the generating system as a whole is relieved from their disastrous effects.

Not the least important part of the generating station is the exciter system, many more or less satisfactory combinations being possible.

The exciters should have a capacity sufficient for all of the synchronous apparatus in the station when these ma-

chines are working at their maximum load and true operating power factor. It is not enough to provide for the excitation when running at unity power-factor, because the excitation which is required at lower power-factors is considerably higher than at unity power-factor.

For small and medium-size plants a 125-volt exciter pressure is generally chosen, while for larger installations a 250-volt excitation will prove more economical.

Although many systems of excitation are in use the one which seems to be the most widely employed and which offers the greatest reliability is that in which the exciting current is obtained from a common source, consisting of as few machines as possible. One or two units are then generally provided for normal excitation, a third being installed as a reserve. It is also common practice to have the regular exciters driven by prime movers, such as steam engines or waterwheels, while the reserve unit is motor driven.

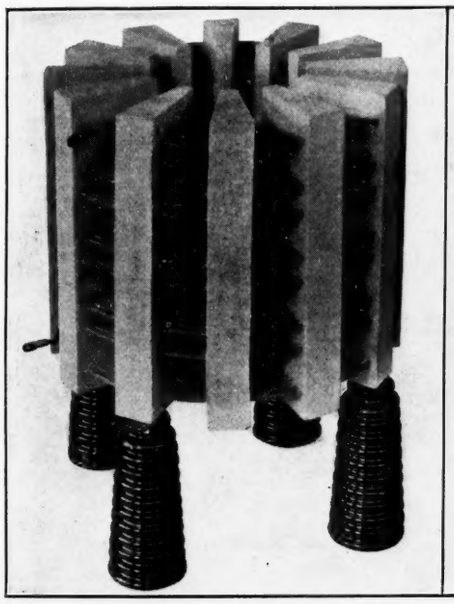
Still another system which is becoming quite common is to install low-voltage generators, driven either by a non-condensing steam turbine or a waterwheel. The exciters are then motor driven, current therefor being obtained from the low-voltage generator. The steam from the turbines is exhausted to the feed-water heaters. In addition to the exciters all the other auxiliaries, such as circulating pumps, etc., are also motor driven.

In order to insure a close voltage regulation of the system automatic regulators are almost always installed in connection with the exciters. These maintain a constant a.c. busbar voltage regardless of the load.

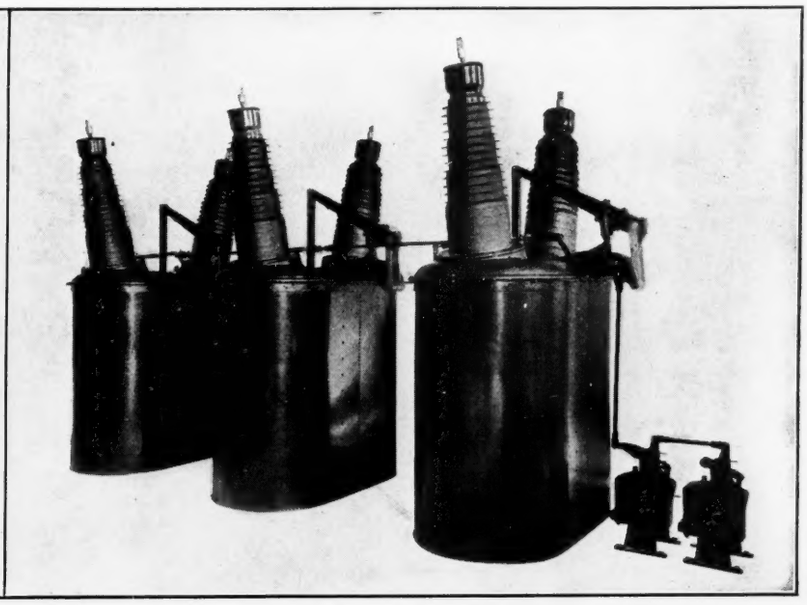
For low- and moderate-voltage installations it is the general practice to install one transformer bank for each generating unit and of the same capacity. For high-voltage transmission systems, the transformer should form a unit with the transmission lines, i.e., the number of groups or banks should be equal to the number of lines. In this manner all high-tension switching, which is highly objectionable, can be avoided, and the same done on the low-tension side of the transformers.

The transformers may be either of the single-phase or three-phase type, and no specific rule can be given regarding the choice, this being usually governed by local conditions. Single-phase transformers are preferable where only one group is installed and where the expense of a spare is unwarranted. In such installations the burning out of one phase of a three-phase unit causes considerable inconvenience, since the whole transformer would have to be disconnected before repairs could be made. If single-phase transformers are used and connected delta on both primary and secondary, the damaged unit can be readily cut out and the other two operated with normal temperature at 58 per cent. of the normal capacity of the group until the damaged unit can be replaced.

With a three-phase, shell-type transformer, if both the primary and secondary windings are delta-connected, trouble in one phase will not prevent the use of the other two in open delta. By short-circuiting both the primary and secondary of the damaged phase and cutting it out of the circuit, the magnetic flux in that section is entirely neutralized.



A Current-Limiting Reactance



A Triple-Pole Solenoid-Operated Oil Switch

Three-phase transformers may be used in moderate voltage installations with a large number of units. For high-voltage developments, where the transformer banks should be of equal capacity to the lines, it is, however, usually necessary to select single-phase transformers so as to obtain the required capacity, and also reduce the cost of the spare unit.

According to the method used in dissipating the heat generated by the losses, transformers may be classified as oil-cooled, water-cooled and air-blast.

In the oil- or self-cooled types the oil heated by contact with the exposed core and windings rises to the surface, flows outward and descends along the transformer case, from which the heat is radiated into the air. The tanks of self-cooled transformers are therefore usually made of corrugated sheet steel to give a greater radiating surface. This type of transformer is the one most generally used.

Where water is available for cooling purposes, the water-cooled transformer is the variety most economical to install. In this type the oil circulates in a manner sim-

ilar to that in the self-cooled type, but the bulk of the heat is carried away by water forced through a pipe coil submerged in the hottest oil at the top of the transformer. Ordinarily the water rate is approximately one-half gallon per minute per kilowatt loss, the temperature of the incoming water being 59 deg. F.

In the air-blast transformer type the cooling is effected by a forced draft of air which is directed through spaces provided between the coils and in the core structure. This class of transformer is applicable for voltages up to about 33,000, but it is being rapidly superseded by the self-cooled type.

The System of Connections Is Important

The system of connections and the switching equipment have a most important bearing on the successful operation of any power installation. When laying out the same the first consideration should be reliability and continuity of operation, while at the same time economy must not be lost sight of.

By carefully planning the connections and by providing switches with selective devices at certain points it is possible to reduce the interruptions to a minimum without exceeding economical limits.

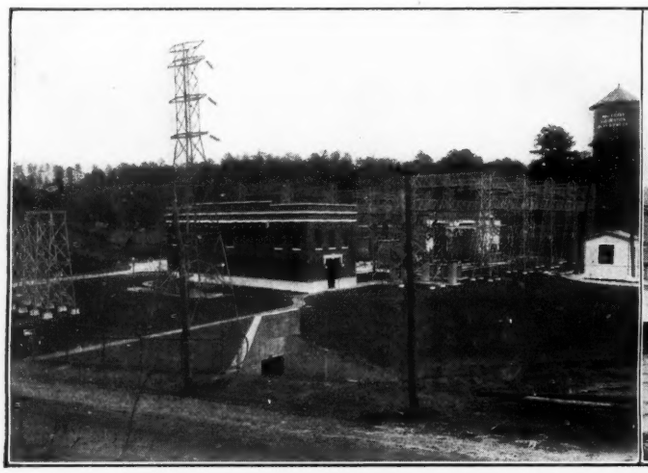
The engineering problems involved in this phase of the subject are rather complicated and differ considerably, depending on the type of installation. As a rule, generators should be paralleled on a low-tension bus, which should be sectionalized if their total capacity exceeds the safe rupturing capacity of the switches. In certain stations no paralleling bus is provided, but simply a transfer bus of light dimensions.

For moderate-voltage stations the step-up transformers, if such are present, are usually also paralleled on the high-voltage side, while for systems employing extreme potentials the different transformer banks should form a part of the line and not be paralleled on the high-tension side, as previously mentioned.

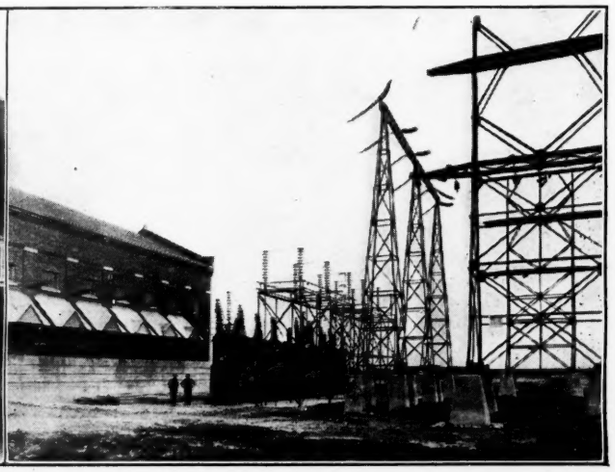
The generator switches, which are installed in the leads between the generators and the low-tension bus, are as a rule of the non-automatic type. As synchronous generators are capable of operating under short-circuit conditions for a limited time, it is considered better to have the operator disconnect a defective unit rather than to have all the machines in the station cut out of service in case of damage to one unit or a short-circuit in the low-tension switch structure.

In certain stations the generator switches are equipped with reverse power relays, in which case a damaged generator would be immediately disconnected from the system through the reversal of the current in its leads.

The transformer and feeder switches should be provided with automatic oil switches, the relays being so chosen that a selective action is obtained, i.e., so that a damaged section may be cut out without disturbing the rest of the system. When deciding on the proper switch and relay equipment for a power system it must be understood that this involves a complete study not only of the generating station but of the operating condition of the entire installation, including transmission lines and substations.



A 60,000-Kw. 110,000-Volt Outdoor Substation



High-Voltage Outdoor Lightning Arresters and Wall-Entrance Bushings

The switching equipment may for convenience be divided in two parts—the switch structure and the control board. This refers particularly to larger stations where the switches are electrically operated and located some distance from the board. For small and even moderate-sized stations it is a common practice to install hand-operated oil switches, which are mounted directly on the back of the switchboard or on a separate framework and operated by hand by means of levers located on the front of the switchboard panels.

In selecting the switches it is not sufficient that they have the proper current-carrying capacity and can withstand the operating voltage. Equally important is their rupturing capacity, i.e., their design must be such that they can safely withstand the effects of the total power which they may be called on to rupture.

The switch and busbar structure may be either of the inclosed or open type, but is usually a combination of the two. It is generally found advisable to inclose all live parts when the voltage is below 22,000. This is due to the fact that the destructive effect of short-circuits depends on the amount of current and is thus inversely proportional to the voltage for the same amount of power. For this reason the low-tension apparatus and busbars in large power stations are generally inclosed in compart-

ments, while their high-tension counterparts are of the open type.

The switch and busbar compartments may be built of brick or concrete, the latter material being almost exclusively used nowadays. For oil switch and busbar structures it is preferable to use brick on account of its greater strength and adaptability to the special forms of compartments and narrow barriers used for this apparatus.

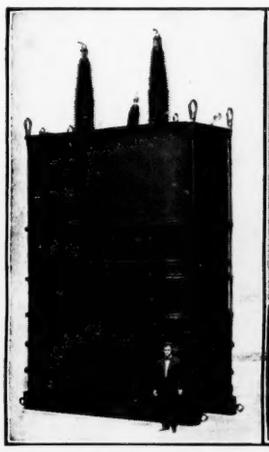
Low-tension busses are generally built up of laminations in the form of flat copper bars. This is the most economical construction since it insures a better radiation of the heat and can be tapered toward the ends where a small cross-section is sufficient. Furthermore the size can readily be increased as extensions are made to the plant. The high-tension bus, however, is almost always made of iron or copper tubing supported on post or suspension insulators.

in large modern stations, as it provides the most compact layout, reducing the length of the board to a minimum. The instruments and meters are then mounted on the vertical panels, while the control switches, indicating lamp, receptacles, etc., are placed on the bench top.

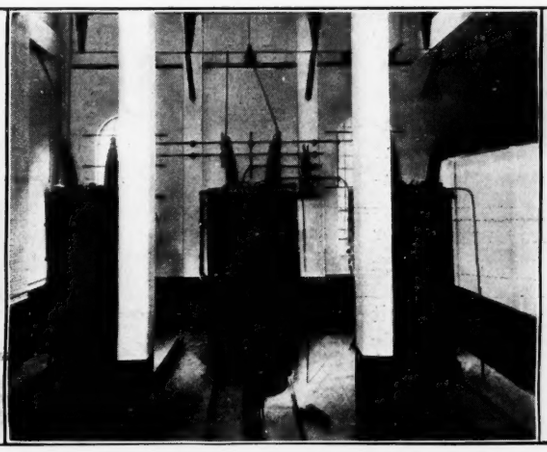
A complete record of the operation of the various units in the station is of the greatest importance, and the instrument equipment should therefore be as complete as possible. Considerable misjudgment is, however, often exhibited in its selection, and the following recommendations may therefore prove useful:

For the exciters provide one ammeter and one voltmeter. If there is more than one exciter, a common voltmeter may be used. This should be mounted on a swinging bracket at the end of the board, and a two-point potential receptacle placed on the panels for each exciter.

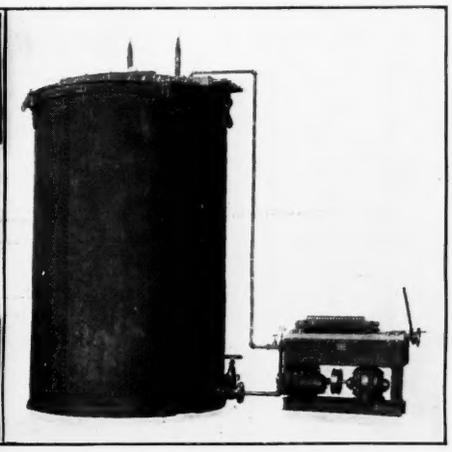
Where these machines are driven by induction motors an ammeter should be provided for reading the current



A 4500-Kv.-a. 750,000-Volt Transformer



A Bank of Three 10,000-Kw. 110,000-Volt Transformers



An Oil Drier and Filter Drying Oil in an Operating Transformer

Every switchboard is, of course, special to a certain extent, as the conditions are seldom alike in different stations. The control board of a large station is strictly not a switchboard in the original sense of the word, as all the oil switches are located remote from it, being merely controlled therefrom. Upon the panels are mounted only the control switches and instruments. These should be arranged carefully, taking into consideration all the operating conditions. For this reason the board is divided up in panels corresponding to the machinery which it controls. The exciter and regulator panels are generally located at one end, then the generator, station, transformer and outgoing line panels in the order mentioned. This arrangement may, of course, be varied so as to more closely correspond to the arrangement of the apparatus.

Two different varieties of construction are customary, namely, the panel and the benchboard types. The panel type is mostly used in small- and medium-sized plants where the switches are located on pipework or in cells in the rear of the board, but near enough so that they can be operated by providing connecting-rods between the handles on the panels and the switches. In certain instances, this type of board is also used where the switches are electrically operated.

Benchboards Preferred in Large Stations

The benchboard construction is the one generally used

taken. The equipment for a synchronous motor when started from the a.c. side should include: One ammeter, one field ammeter, one polyphase indicating wattmeter; this latter may however be omitted.

For generators provide: Three ammeters, one polyphase indicating wattmeter, one voltmeter, one field ammeter, one four-point synchronizing receptacle, one eight-point voltmeter receptacle.

As all three-phase systems are more or less unbalanced, it is preferable if an ammeter is provided for each phase. In small installations one ammeter may be installed and a plug and receptacle provided so that the instrument can be connected to any one phase and the current read.

Indicating wattmeters are important, as it is not possible to determine by any other means the division of load between two alternating-current generators running in multiple. The ammeters do not differentiate between the idle current and the line current from the machines, and thus are of no use in determining the division of the load. In large stations it may also be advisable to provide a polyphase watt-hour meter for registering the amount of power which is generated.

Field ammeters are useful, but not absolutely necessary. They serve as a check on the generator in case of trouble, and are invaluable in testing therefor.

Voltmeters are, of course, used to read the voltage of

the machine before it is connected in multiple with any other. They are also used to indicate the potential of the buses, and the eight-point receptacle is to connect the voltmeter to any of the phases.

The synchronizing receptacle is used to connect the generator to the buses leading to the synchronizing indicator. It is preferable to synchronize between machines and not between a machine and a bus. For this reason two plugs must be provided, one for "starting" and the other for "running," i.e., when sychronizing, the starting plug is inserted in the receptacle of the machine to be started, while the running plug is inserted in the receptacle of one of the operating machines. The synchronism indicator will then show whether the incoming machine is running too slow or too fast.

The station panel equipment should consist of one synchroscope, one power-factor indicator, one curve-drawing voltmeter.

In certain installations it may be advantageous to provide an indicating voltmeter permanently connected to the bus. A better comparison can thus be made between the bus and generator voltage when synchronizing. A curve-drawing voltmeter giving a continuous record of the bus pressure is of great value and in certain installations the importance of the service may be such that it is advisable to provide frequency and power factor indicators of the curve-drawing type.

Station feeders should be provided with: One ammeter with plug for reading current in either phase, one polyphase watt-hour meter (in large stations).

One ammeter may be provided in the low-tension circuit of each transformer bank. Outgoing lines are generally provided with three ammeters. These are usually of the series type, mounted on post insulators and located at a convenient point in the high-tension structure.

The electrical disturbances common with electric power developments may be divided into two general classes; first, those caused by excessive currents, and, second, those caused by high voltages.

Maximum Temperature Attained by Machine Determines Safe Load

The safe load which a machine can carry is determined by the maximum temperature which its insulation can withstand, and while machines as a rule are able to carry considerable overloads for a certain period, if this is greatly exceeded the insulation will rapidly deteriorate, resulting in a burn-out. For protecting apparatus against undue overloads of this kind automatic switches are provided in their circuits.

The excessive currents which are caused by short-circuits may reach high momentary values, and result in severe stresses being imposed upon the apparatus, which in turn may result in a failure of the insulation and a complete shut-down of the damaged apparatus if not the entire system. With the present tendency to concentrate large amounts of power, it is evident that the effects of a short-circuit may prove to be disastrous, and that means must be provided to limit current rushes to a safe value. On the other hand the system should be so sectionalized that the damaged part may be quickly isolated.

The most common method of reducing short-circuit currents is by introducing artificial reactance coils in the various circuits. These may be placed in the generator leads, in the low-tension transformer leads, between the busbar sections or in the outgoing feeders, the particular location being dependent upon the type of installation.

Devices for Reducing Short-Circuit Currents

Various schemes have also been devised for automatically reducing the value of the current which the generators are capable of delivering under short-circuit conditions. As almost all modern generators are controlled by automatic voltage regulators the tendency of these would be to hold up the voltage when a short-circuit occurs, but means are now often introduced which will result in a lowering of the generator voltage under such conditions.

High-voltage disturbances may, also, be divided into two classes; first, those covering actual high voltages in which the excess potential exists between phase conductors or between phase conductors and ground; and, second, localized high voltages which take place in the transformer windings, being caused by high-frequency impulses or traveling waves which are set up somewhere along the transmission lines. For guarding against the former class the aluminum cell electrolytic lightning arrester possesses ideal characteristics and is extensively employed, giving satisfactory protection.

Overhead ground wires are also used to a great extent to protect the transmission lines against static discharges, and in this connection it might be stated that a lighning arrester is not intended to protect the transmission lines but only the station apparatus, and while they could, of course, be installed and distributed along the lines, such a scheme would prove entirely impossible from a commercial viewpoint, for which reason ground wires are employed.

For protection against the second class of high-voltage disturbances, which are caused by high-frequency impulses, no satisfactory remedy has as yet been found. Extensive research work to devise such means is now being carried on and there is every indication that in the near future high-voltage disturbances can be guarded against in just as satisfactory a manner as are the disturbances caused by excessive currents.

Plant of the Alba-Melakoff Lignite Co. in Texas

Special Correspondence

This company has a well equipped plant, with modern machinery. The employees are nearly all Mexicans, this nationality appearing to be the most plentiful in that part of the country. They seem to make very good miners, with the exception that they do not like regularity.

The coal is at present being hauled by mules, but the company expects to install cable or motor haulage in the near future. The seam is 6 ft. in thickness and is worked on the block system, a total of 400 tons per day, of a very fine grade of lignite, being taken from the mine, on a four days per week basis. This time last year the company was working full time and could not supply the demand. The cotton situation in the Southwest has hurt the lignite mining business, as it has almost all other classes of labor. The average miner receives $2.75 per day, while some of the best men make as high as $5 a day. A breast auger is used for drilling and black powder for shooting purposes.

The How and Why of the Condenser

By H. E. Beyer*

SYNOPSIS—The usual method of calculating the efficiency of a condenser is to compare the actual vacuum attained with that theoretically possible. The ratio of the vacuum and hotwell temperatures tells a different story.

It is the purpose of this paper to describe the underlying principles entering into the theory of economical condensation of steam and vapor by means of the jet condenser.

In order that the description may be more clear it might be well to preface it by the statement that a condenser is a heat transferring apparatus, being the reverse in its action of the steam boiler. The boiler generates steam; the condenser destroys it. And as transfer of heat naturally involves temperature change it may be said that the efficiency of the operation of transferring exhaust steam into hotwell water may be best ascertained by means of the thermometer.

The reason why temperatures are not more commonly used as the basis, is probably due to custom and prejudice. When Thomas Newcomen brought out his atmospheric engine in 1705 and which in reality was a steam condenser (the steam was admitted into a cylinder and then water introduced to condense it, the pressure of the atmosphere forcing the piston into the vacuum thus formed) thermometers were not available as they now are. Gages of the water or mercury column type were more accurate with the facilities of manufacture then existing, with the result that in the early days of steam engineering the practice was evolved of measuring in inches and in pounds; and because the present day science of steam engineering has been built on such measurements, this practice has been continued in condenser work.

But it would seem a useless procedure with the modern ability to manufacture thermometers which will fulfill the requirements of ordinary accuracy, that we should go to the trouble of transferring gage readings expressed in vacuum inches or in pounds absolute, correcting them for the local barometer, and then reduce them to temperatures in order to ascertain how efficiently a condenser is working when it is much more direct to take the temperatures of the inlet and outlet water and of the exhaust steam. These three readings give all the data necessary to ascertain how efficiently the condenser is working.

If for example we know that cooling water enters a condenser at 90 deg. F., that the exhaust steam has a temperature of 115 deg. F., corresponding to 27 in. of vacuum, and that the hot well water has a temperature of 113 deg. F., we know we have an efficient machine. If the waste water leaves at a temperature of 105 deg. F. we know that we have not; the amount of cooling water required with the latter condition being somewhat over 50 per cent. more than is required in the first case. So it would seem that the terminal difference actually carried between hot-well and exhaust steam temperatures should be the measure of efficiency, and the basis on which condenser guarantees should be determined.

As is evident from the above, the temperature of the hot-well water has a direct bearing on the part the steam in the condenser plays in the process of its destruction. If the rejected hot water is heated up to the temperature corresponding to that of the exhaust pipe, it shows that the steam has been deprived of all its heat, and therefore having ceased to exist can exert no pressure in the condenser. In other words, the efficiency represented would be 100 per cent.; and as most condensers in use today operate on a basis of more like 50 per cent. efficiency there must be a reason, and this reason is the air present in exhaust steam and cooling water.

Air is noncondensable, and the action of the cooling water is to disintegrate the mixture of air and steam. The more air there is in the cooling water the less its ability to properly disintegrate the steam and its air, and the less air there is in the cooling water the greater its ability to do so. So it is evident that cooling water, freed of air, will insure the highest efficiency of heat transfer occurring in the condensing process.

Most condensers put on the market and in use do not free the cooling water of air before the water mixes with the steam, and the result is a low efficiency of heat transfer. Not only must sufficient cooling water be supplied the condenser to absorb the heat of the entering steam, but an additional amount must be furnished to cool the air in the water itself, as otherwise this air would be so expanded in volume by contact with the steam, as to seriously impair the vacuum.

That is why jet condensers which depend upon a throat or water pump to carry off the mixture of hot water and air always give a low vacuum when the temperature of the cooling water is raised or the amount of water is cut down.

To relieve this condition resort is sometimes had to air pumps, but the addition of an air pump to a condenser which does not free its cooling water of air before it comes into contact with the steam gives relief mainly during the summer time when the cooling water gets hot; in winter when the water is colder as good a vacuum can generally be obtained without the pump as with it.

The efficiency of 50 per cent. in regard to heat transfer applies to condensers which come under the group classified in the art as "parallel-current," as contrasted to the type known as "counter-current." Counter-current condensers remove the air from cooling water before it comes in contact with the steam, rendering possible a much higher efficiency of heat transfer. Properly designed counter-current condensers will operate on a 2-deg. terminal difference and their efficiency of heat transfer will range from 90 per cent. to 98 per cent. Knowing this it may seem strange that the majority of condensers in use should not be of the latter type rather than the former.

Until recent years little attention has been paid to the efficiency of condensers because of the low vacuua deemed necessary. The cooling water formerly available was colder and purer than at present due to fewer steam plants in any given territory, so that with such conditions

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NOTE—A paper read before the Alabama Light and Traction Association.

almost any old thing would do as a condenser. The large increase in the number of condensing power plants in every locality which frequently, by their re-use of river water as an instance, has changed operating conditions, so that now hot cooling water, frequently foul, and carrying much foreign material is the rule. This coupled with the higher vacuua required by modern steam practice demands a more fool-proof and efficient condenser. This demand is being met by the use of the counter-current type of condensing apparatus.

In a counter-current jet condenser the cooling water enters at a point above the steam entry. Low velocity of mixing is employed, the steam entering at from 200 to 400 ft. per second, as contrasted to 700 to 1000 ft. in the parallel-current type. The water is allowed to drop from a position of rest so that its velocity is due only to the pull of gravity. This ensures thorough mixing. To remove the air and noncondensible gases a dry air pump is necessarily used. This machine takes the air from a point well above the cooling water entry.

This arrangement means that the water entering the condenser is immediately freed of its air content, in proportion to the vacuum. The cooling water relieved of this air and with the slow mixing process employed can then absorb to its full ability the latent heat of the entering steam, and can also more effectively cool the hot air released from the steam and which passes up through the falling water to the point where the air pump removes it from the condenser.

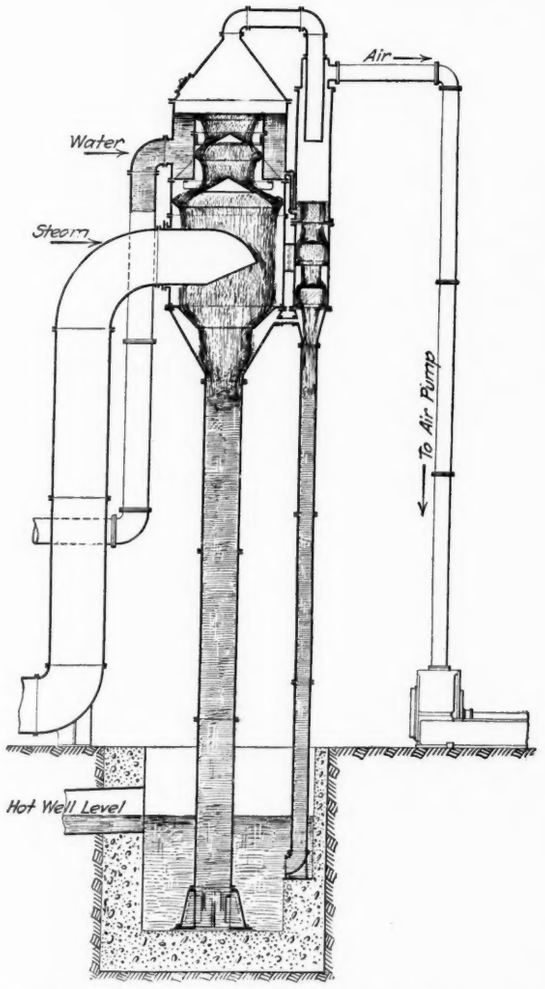
As the hot water running off is at the extreme bottom of the condenser, and the air practically cooled to the temperature of the incoming cold water, is at the extreme top, a high efficiency of heat transfer can be obtained. Further, the air passing to the air pump being cooled to the lowest possible point, it will be correspondingly dense, so that the power required to remove it from the condenser will be the minimum. High efficiency of heat transfer means a small amount of cooling water required, and the combined horsepower of the air and water pumps will be the lowest possible.

On reliable tests a counter-current barometric condenser handling the exhaust steam from a 5000-kw. turbine has required but $\frac{5}{10}$ of one per cent. of the power of the main unit when maintaining 28 in. of vacuum with 65 deg. temperature of cooling water at full load. On smaller units of course, this ratio is higher, but even with 500-kw. machines 2 per cent. should be a fair average.

While reference has been made to the slow mixing process employed in counter current condensation, it is equally essential to have the air removed from the condenser top at a slow velocity and that the hot water running off does the same. This means large air and tail pipes at top and bottom respectively; and in the case of the low level type of condenser large diameter below the steam nozzle. There should be no siphonic effect at the bottom due to velocity of water flow at that point.

Coming to the practical side of the matter, it will be found that an air pump taking air out of a counter current condenser without the medium of a suitable water separator, will constantly be troubled with water in the cylinder due to the condensation of the moisture content of the air. The air leaving the condenser is saturated and as it gets cooled on its way to the pump it drops its moisture content. This water trouble is effectively prevented by means of a simple separator which changes the direction of the air so as to shake the moisture out by the time it enters the suction pipe between condenser and pump.

In the same way, it is necessary to lead the exhaust steam into the center of the condensing space so that the cooling water forms a complete cloak or umbrella, in the center of which the steam is delivered. The steam then blows out against this water and all the water required per unit of time meets all the steam entering during the same period, so that there is no wire drawing.



CROSS-SECTION OF A COUNTER-CURRENT BAROMETRIC CONDENSER

In addition to the feature of high efficiency, there is a most practical advantage derived from the above construction, in that the condenser will not clog up due to any rocks, wood, fish, grass or other foreign material which may enter with the cooling water. There are no springs to adjust; no contracted passages in the interior, and the condensing vessel itself needs no more attention than the exhaust pipe. The air pump can be placed at any convenient location, and in the same way the condenser can be put at any desired distance from the engine or turbine. It is also possible to have one condenser handling the exhaust from several prime movers. Last year there was installed a 15,000-hp. condenser for a large steel plant, which has 1500 ft. of exhaust piping leading to it.

Having explained the operation of the counter-current condenser and expressed the opinion that the thermometer is the proper means of recording what the condenser is doing, it may be interesting to give a comparison between this and the method generally employed by engineers This method expresses efficiency by the per cent. of ideal perfect vacuum actually obtained, and neglects the operation of heat transfer entirely. If the hot-well for instance has a temperature of 79 deg. F., the corresponding vacuum is 29 in. If the vacuum observed is 28.62 then according to this method the efficiency would be $\frac{28.62}{29} = 98.6$ per cent., and this reading would show that the condenser was doing pretty good work. An examination of the heat transfer process however shows that this is quite the reverse, and a comparison is given below, the figures being taken from actual reported tests published by the builders.

	Counter-Current	Parallel Current
Temp. cold well	66 deg.	65 deg.
Observed vacuum	28.62 in.	28.62 in.
Temp. of vacuum	89 deg.	89 deg.
Temp. hot-well	87 deg.	79 deg.
Temp. difference	2 deg.	10 deg.
Per cent. ideal vacuum realized	99.7	98.6
Latent heat per lb. steam at vacuum..	1043.69	1051.66
Lb. water actually required per lb. steam	49.7	75.1
Lb. water theoretically required per lb. steam for 100% efficiency	45.3	43.4
Efficiency heat transfer	91%	58%

The above comparison shows that by the method of figuring efficiency on the ideal vacuum basis that a condenser operating on a 10-deg. difference is apparently as good as one working on a 2-deg. difference; but when we come to compare the same condition on the heat transfer basis we find that the 10-deg. terminal difference condenser uses 50 per cent. more water and has an efficiency of 60 per cent. as compared to that of 96 per cent. for the counter-current with a consequent increase in the power required to operate the auxiliaries.

Extracts from a Superintendent's Diary

I did a thing today which I have always said I would never do, and I am more than disgusted with myself for having done it; I addressed an open meeting of our miners' union and attempted to convince them that they could not justify the calling of a strike against our company at this time, no matter what the unions at the other camps in the state might recommend.

Over my desk hangs this bit of wisdom: "Never try to reason the prejudice out of a man—it is not reasoned into him, and cannot be reasoned out."

I haven't been able to get my eyes away from it since I came back from the meeting.

I realize now that my error was simply the result of allowing my enthusiasm to get the better of my judgment.

For a long time past I have been congratulating myself upon my success as a leader of men. It has seemed to me that I have been faithful to my convictions, and I have been able to impress my convictions on all who call me boss. I take my convictions seriously and have arrived at them only after much earnest deliberation. And not only have I been master of my men, but the higher officials of my company have usually come around to my way of thinking.

And now it appears that while I have been floating along in the clouds, my men have been taken in hand, secretly, by the national union officials and reminded of the great gap that exists between what they have accepted as satisfactory and what really ought to satisfy them.

It all came to the surface very quickly and in a way that could not be misunderstood, as soon as I threw down the bars at the meeting this afternoon.

"Loyalty to the company that has been loyal to you is all that we ask for" was the burden of my talk and they heard me through without an interruption. Then they began to ask questions, and such questions they were.

"Who were our directors?" "How did they make their money?" "Why did they organize our company after they had already accumulated so much money?" "Why did they not come to inspect their property in person?"

In my prepared speech I had intimated that local unions were led into all sorts of predicaments, principally, because the national organization was ruled by men living at a great distance who could not be in close touch with the local members. "How many of you know whether your national leaders are honest or are simply grafters like so many that have gone before them? Do you know enough about them to justify an opinion that they are not leading you into this course for selfish reasons?" was the way I put it.

My line of argument impressed them and they returned the compliment.

Little I knew about the personal history of our directors and everyone present soon realized that.

The effect of my embarrassment on my audience was magical; men who had never been known to question any act felt called upon to open fire and join in the general attack.

The president of the union, realizing no doubt that too much argument might react against his cause, got control of the meeting and brought it to a close.

And to think that during the past five years I have had that precept on prejudice hanging over my desk, staring straight into my eyes whenever those eyes were lifted from their work.

A Congressman on Feudalism

Congressman David J. Lewis of Maryland recently testified before the Federal Industrial Relations Commission as follows:

A man can no longer own a coal mine as he owns his house and garden. Suppose a friend and I were to find 10,000 acres of coal lands in West Virginia. We ought to exploit the mines we would open for the good of society. We must take the miners out there and build them houses. This gives us the relation of landlord and tenant, as well as employer and employee. Then we may have to start commissary stores. This gives us a third relation. And also we may be obliged to supply the doctor, and perhaps even the saloon for our miners.

Because of relations like these, if mine employees have trouble with their employer, the result to them is disastrous. It affects all their relations to life at once, except toward their wives and children. Not only their work, but their homes and their stores are gone, and it is inevitable that trouble arises when the employer tells the men to move out.

The employer is not wholly to blame, for society has told him that the mine is his just as are his garden and cottage. But such relations are impossible in this country. They are a feudalism grosser than English history has ever shown. If all the country was in the same state, we should either cease to have private property or the Republic itself would perish.

The Stoker in Coal-Mine Power Plants

By Alfred Lotz*

SYNOPSIS—True conservation applies alike to the production and utilization of any natural resource. By means of proper equipment the producers of coal can make use of low-grade fuel, thereby releasing to the market a salable product.

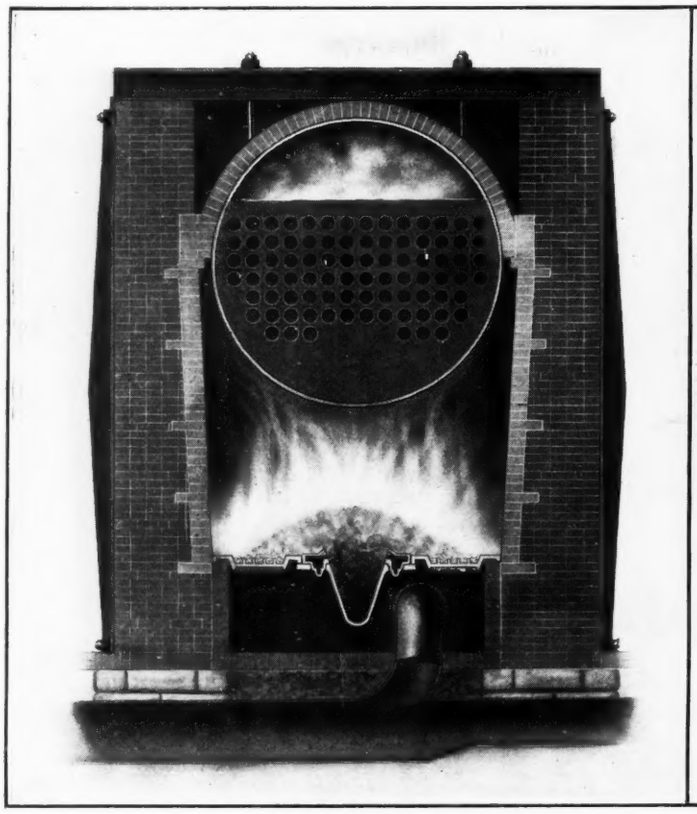
For many years past, numerous articles have appeared in the various trade journals dealing with the waste of our natural resources, the inefficiency with which the same have been handled, and calling attention to modern methods whereby various materials may be utilized with greater economy, thereby helping in a measure to conserve these natural products by using less of them per unit of output.

This is particularly true of coal, undoubtedly the most extensively used article of all our natural products, and until recent years probably the most wastefully handled, by large and small consumers alike, but particularly by the coal-mine operators themselves.

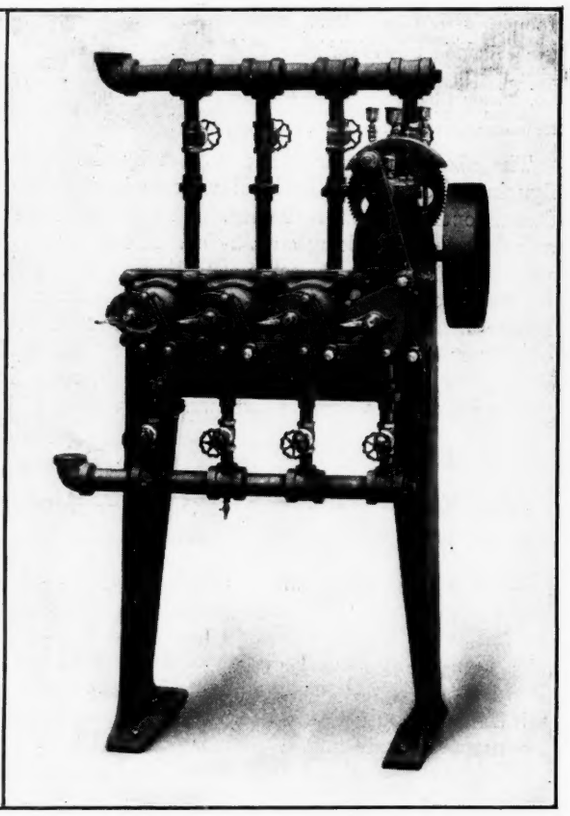
Of late years, however, both large and small power plant operators, who are paying out their good money for fuel, have come to the realization that they would be money ahead could they burn the coal more efficiently, cut down waste, and use less fuel per unit of output. Many have consequently resorted to mechanical stokers for this purpose.

This did not, however, apply to the coal-mine power plant except until recent years, principally because the fuel cost charged to the plant was that of mining, and as it costs just as much to mine poor coal as good coal, the latter was used in the plant instead of being sold at a profit, and the poorer grade, such as machine cuttings and slack, was dumped on the waste pile, there being no market for this material. Because of the prevailing opinion that low-grade fuel could not be utilized or that it would not pay to burn it, mines all over the country accumulated thousands upon thousands of tons of what was presumably just "waste."

When, however, the purchasers became more critical as to quality and price, and the competition among producers waxed keener, some of the more progressive operators began to consider the possibility of utilizing this "waste," which possessed considerable heat value, and of remodeling their power plants with this end in view.



Cross-Section of Furnace, Showing Retort, Tuyere Blocks, Dead Plates, Etc.



A Cole Automatic Valve Controlling the Stoker

Fluctuating Load Is Encountered

Considering the character of the waste to be burned and the highly fluctuating load of a coal-mine power

*Mechanical engineer, Under-Feed Stoker Co. of America, Chicago, Ill.

plant, it soon became evident that not every stoker would meet these requirements. On account of the high percentage of noncombustible matter in cuttings, "bony" coal, etc., the air spaces of the grates of some types of natural draft stokers become clogged. This would necessitate a larger number of boilers when burning this fuel in order to get the same amount of steam, while other conditions would not be materially changed from the old hand firing practice except for the automatic feeding of the fuel.

Another important point is that with natural draft stokers no better regulation can be obtained than with hand firing to take care of the highly fluctuating loads encountered in mining operations, and the only manner in which any approximation to a constant steam pressure is attained through hand regulation by the stoker attendant, who can change the stoker speed and manipulate the stack damper as the load fluctuates from heavy to light. This leaves the question of "steady steam" entirely to the

VIEW IN THE BOILER PLANT OF THE UNITED STATES COAL & COKE CO., GARY, W. VA.

"human equation," the same as with hand firing. All operators appreciate the fact that this is rather uncertain.

In the underfeed stoker using forced draft the objections cited above have been overcome. It is possible with such a stoker to utilize unmarketable coal, obtaining comparatively high efficiency and also secure an entirely automatic regulation of the fuel and air supplied to the furnace, by direct action of the steam pressure on an automatic regulating device, thereby eliminating the necessity of depending on the judgment of the fireman.

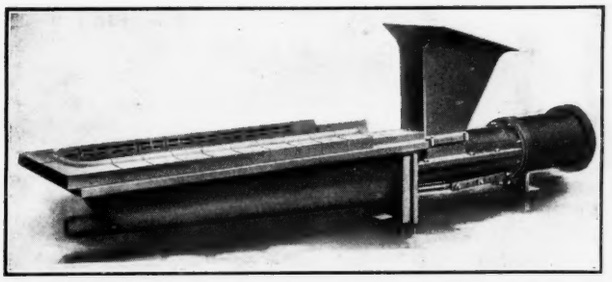
The Jones underfeed mechanical stoker has been successful in solving this very important question in coal mine power plants on account of its extremely simple construction and method of operation. It is entirely automatic in its control of the steam requirements of the plant, responding almost instantly to fluctuations in the load and being independent of the fireman in its operation. This is especially true where the fuel can be spouted to the stoker hoppers from overhead bunkers. Where there are no overhead bunkers the fuel must, of course, be shoveled into the hoppers by hand.

By referring to the illustrations it will be seen that the stoker consists of a steam-actuated piston connected to a ram which forces the coal coming down from the hopper above into a retort under the boiler. The steam cylinder, ram and hopper are located outside the boiler setting, while all else pertaining to the stoker proper is placed within the furnace.

Around the upper edge of the retort a number of air blocks or tuyeres are located. These connect to the chamber beneath the retort, which in this system is an air-tight compartment from which the air for combustion goes up through the tuyeres and mingles with the coke and gases distilled from the coal. The grate area in the furnace not taken up by the retort is completely filled with iron dead plates, which form the top of the air chamber.

An iron pusher rod with blocks or shoes, which is operated by the ram, is located in the bottom of the retort. This serves the purpose of giving an even distribution to the coal in the furnace. There are only two moving parts to the stoker proper, and these do not come in contact with the fire. No valves are employed on the stoker, the steam cylinder being connected to what is called a Cole automatic valve which gets its motion from the fan shaft by means of a belt connection.

The operation of the system is simple. The regulating valve between the steam line and engine driving the forced-draft fan is set to whatever pressure is to be carried on the boiler, and the Cole automatic valve is ad-



THE STOKER PROPER, SHOWING PARTS INTERNAL AND EXTERNAL TO THE BOILER SETTING

justed according to the quality of the coal to be burned.

Should there be little or no load on the boilers the engine, fan and Cole automatic valve will move only fast enough to keep the steam pressure at the desired point. Should the load be thrown on the boilers suddenly, the regulating valve will allow more steam to the engine, which will speed up accordingly, driving the fan at a greater speed, likewise the Cole automatic valve. This in turn operates the stoker faster, thus supplying the furnace with more coal and the proper amount of air to keep the steam pressure constant under the increased load. Should the load suddenly drop off the coal and air supply will decrease in proportion on account of the automatic slowing down of the entire system. Consequently no more coal is ever burned than is necessary.

There is no reason why coal operators should not practice the same rigid economy in their power plants that manufacturers follow in all other lines of business. If coal producers can profitably use in their boiler stations nonmarketable fuel, which would otherwise be wasted and thereby add to their merchantable output an amount equal to what they would have had to burn under ordinary conditions, obtaining a profit on the same, it stands to reason that they will be money ahead.

Unimportance of Power Questions in Jig Problems

By Geo. R. Delamater

The question may be raised as to whether capacity should not be considered in calculating the efficiency of each individual jig. It has been pointed out to me that some jigs will wash coal at the rate of 20, 30 or 40 tons per hour, while others will only handle 5, 10 or 15 tons in that time. My experience has been that jigs of high capacity are of large screen area. They may be of one compartment only, but in such cases are usually adapted only to fuels which do not require to be crushed fine to attain the necessary breaking away of the impurities from the coal and in which the specific gravities of the impurities are much greater than that of the fuel.

They may be jigs of more than one compartment, in which case either one or two plungers are required for each compartment. The amount of water used on such jigs is practically of the same ratio to the amount of coal washed, regardless of the capacity of the jig. In fact I have always found that the amount of power required and the amount of water used are practically the same per ton of coal washed, regardless of the capacity of the jig. Again, two jigs of exactly the same design but of different sizes may operate at exactly the same cleaning efficiency. As an example, they may be the same machines throughout except that one has a width of 6 ft., while the other is 3 ft. wide. If the percentages of washed coal and their analyses are the same, the cleaning efficiencies are equal. In two machines of this kind a certain amount of the power required is consumed in overcoming the friction, etc., within the machines themselves and the larger machine probably uses little if any more power for this purpose than does the smaller one.

A considerable increase in power consumption by the larger machine will result from the increased amount of work done, and I have found that, within the rather limited extent of the variation in jig sizes to be found in actual practice, the reduction in the power consumption per ton of coal washed in the larger jigs over the smaller, is practically negligible. I, therefore, very seriously question the use of the jig-capacity figures as having any bearing on the efficiency of washing.

If the capacity figures are to be used at all, they should be reduced to the capacity per square foot of screen area of the jig, and even then, to use them in calculating efficiencies, some standard must be adopted representing 100 per cent. efficiency for one square foot. That to me seems practically impossible as all the other data obtainable for these calculations are based on float-and-sink tests. Besides this, any standard assumed for a square foot of screen area would necessarily be a variable depending on the size of the coal treated and the specific gravity of the materials constituting the raw coal.

After due consideration of these features of the problem it appears to me that the capacity of a jig settles down to a cost per ton of coal washed. The first consideration of every coal-washery owner, or intended owner, is the efficiency of cleaning the coal. If he could operate a jig at a capacity of 100 tons per hour at a cost of half a cent a ton, but at a cleaning efficiency of but 15 per cent., he would unquestionably be more interested in a jig that would clean his coal at a capacity of but 10 tons per hour at a cleaning efficiency of 95 per cent., even though the cost might be three, four, five or six times that of the other machine.

I, therefore, firmly believe that the capacity should play no part in the efficiency calculation except where there are several jigs of unequal output; then the efficiency of each jig may be multiplied by its output and the total of these products divided by the whole tonnage to find the average efficiency of the whole plant.

*Consulting engineer, Haddon Heights, N. J.

The Comparative Cost of Electrical Heating

By A. J. Weichardt

An interesting comparison of the cost of electrical heating versus coal heating is as follows:

One horsepower, or 33,000 ft.-lb., is equivalent to 746 watts, and 778 ft.-lb. are equal to one British thermal unit.

Expressed algebraically this is

$$\frac{746\ watts}{minutes} = \frac{33{,}000\ ft.\text{-}lb.}{minutes} \qquad (1)$$

$$778\ ft.\text{-}lb. = 1\ B.t.u. \qquad (2)$$

From (1) and (2)

$$\frac{1\ kw.}{1\ kw.} \times \frac{minute}{hour} = \frac{56.86\ B.t.u.}{3411.6\ B.t.u.} \qquad (3)$$

Georges Creek, Pocahontas, or any good grade of bituminous coal will average from 14,000 to 14,500 B.t.u. per pound. Assuming, then, that the best grade of domestic coal has a heating value of 14,000 B.t.u., the results will be as shown in the accompanying table.

A consideration of the table shows that, with a furnace efficiency of 20 per cent., it is optional whether one pays ½c. per kw.-hr. for electrical heat or $8.20 per ton for coal.

At the more common price of 10c. per electrical unit, and using a steam boiler of 80 per cent. efficiency, one could afford to pay $656.58 for a ton of coal and come out even.

If it were possible to obtain a perfect furnace, $820.73 is the price that could be paid for a ton of coal in even competition with 10c. electrical heating.

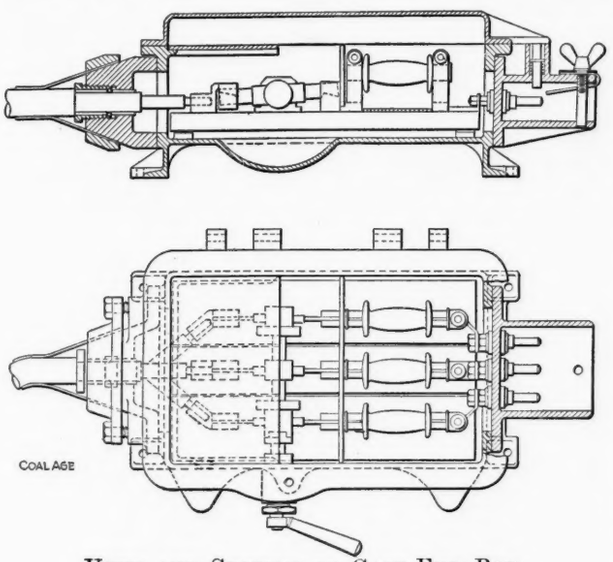
If a Kw.-hr. Cost	The Equivalent Value of Coal per Ton of 2000 lb. for the Following Furnace Efficiencies Is:										
	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	5%
½c.	$41.03	$36.93	$32.82	$28.72	$24.62	$20.52	$16.41	$12.31	$8.20	$4.10	$2.05
1c.	82.07	73.87	65.66	57.45	49.24	41.03	32.83	24.62	16.41	8.21	4.10
2c.	164.14	147.73	131.31	114.90	98.48	82.07	65.65	49.24	32.83	16.41	8.21
3c.	246.21	221.59	196.97	172.35	147.73	123.11	98.48	73.87	49.24	24.62	12.31
4c.	328.28	295.45	262.63	229.80	196.97	164.17	131.31	98.49	65.66	32.83	16.42
5c.	410.36	369.32	328.24	287.21	246.18	205.15	164.12	123.09	82.07	41.04	20.52
6c.	492.44	443.20	393.95	344.71	295.46	246.22	196.98	147.73	98.49	49.24	24.62
7c.	574.51	517.06	459.61	402.16	344.71	287.26	229.63	172.35	114.90	57.45	28.73
8c.	656.58	590.92	525.26	459.61	393.95	328.29	262.63	196.97	131.32	65.66	32.83
9c.	738.66	664.79	590.93	517.06	443.20	369.33	295.46	221.60	147.74	73.87	36.93
10c.	820.73	738.66	656.58	574.51	492.44	410.36	328.28	246.21	164.14	82.07	41.03

TABLE SHOWING THE RELATIVE COST OF HEATING BY ELECTRICITY AND BY THE BEST GRADES OF COAL WITH DIFFERENT FURNACE EFFICIENCIES

A Gate-End Switch Box

The accompanying illustration shows a gate-end switch box constructed by the Diamond Coal Cutter Co., of Wakefield, England, which has been standardized for 75 and 100 amp. at 550 volts, both as a single, two- and three-fold box. The drawing is practically self-explanatory.

The case is made of special high-tensile metal with side-flanged joints. These, together with the provision of cooling escapement glands, render the box explosion-proof. Interlocking devices prevent the possibility of switching on the circuit until the lid is closed or of



VIEW AND SECTION OF GATE-END BOX

opening the box while the current is on. Moreover, live contacts cannot be touched when the lid is open. The aluminum adaptor cannot be inserted or withdrawn when the switch is in the position and is automatically locked and a complete ground established before the current can pass.

The fuses are contained in porcelain holders and the glands are made to suit the cables installed. The box can only be opened by the detachable handle, which is the key, and hence the switch may be claimed to be entirely fool-proof, owing to the practical impossibility of accidental misuse or shocks.

Coal, the Big Item in Power-Plant Operation

The largest single item in the operating costs of any steam power plant is coal. In most plants the purchase of coal is a matter of careful consideration, and in the larger ones it is usually bought under specifications. Once the coal is in the bunkers, this careful consideration stops and the actual burning of the coal is very rarely given more than a passing thought, as long as the steam pressure is kept up. Of course, there are some plants where this does not apply, but in the majority it does, says POWER in its Feb. 2 issue.

The men employed are paid the lowest possible living wage and are chosen more on the basis of the wages they will work for than the results they are able to produce. The man who burns the coal can easily vary the efficiency of the boiler by 10 to 15 per cent., or the heat absorbed by 15 to 20 per cent., yet he is at the bottom of the payroll.

No revolutionary advancement has been made in power plants recently, and the increased efficiency is accomplished only by taking each process separately and bringing it up to the highest standard. It would therefore seem wise, in attempting to increase the overall efficiency of a plant, to start with the item that represents the largest expenditure and work down the list.

In office-building plants the cost of coal represents some 35 to 40 per cent. of the total expense, and boiler-room labor 12 to 15 per cent. In big plants the cost of coal is 50 to 55 per cent. and the boiler-room labor 7 to 8 per cent. Take a concrete case of a certain office building in New York City that employs two firemen at $600 a year each. Their coal costs approximately $10,000 a year. If we assume that the boiler efficiency is 60 per cent., and that by paying $900 a year men could be obtained who would operate the boilers at an efficiency of 70 per cent., it would be a paying investment. The increase in wages is $600 a year. The increase in boiler efficiency amounts to a reduction in coal burned of 14.3 per cent., or $1430. The net result is $830 to the good by the change—not a matter of philanthropy.

Any plant owner can figure out for himself what a small increase in the boiler efficiency will amount to in dollars and cents, and may find it profitable. The efficiency of the boilers may be increased in several ways, but first, proper equipment must be furnished. Every boiler plant should be equipped with a draft gage, stack thermometer and means for determining CO_2. The cost of this whole equipment need not exceed $100, which would be repaid in a very short time.

Then the firemen should be taught the use of this apparatus to determine the proper method of handling the fires to secure the highest efficiency. A bonus system for savings over a certain amount would probably be productive of the best result. If the firemen are able to save the plant money by their efforts, they should logically be entitled to a part of it.

Bureau of Mines Rescue Cars

CAR NO. 4

Krebs., Okla., Feb. 7 to 13.
Buck, Okla., Feb. 14 to 20.
Carbon, Okla., Feb. 21 to 27.
Adamson, Okla., Feb. 28 to Mar. 6.

CAR NO. 8

Berwind, W. Va., Feb. 10 to 18.
Panther, W. Va., Feb. 19 to 28.
Glen Alum, W. Va., Mar. 1 to 9.
Thacker, W. Va., Mar. 10 to 19.
Matewan, W. Va., Mar. 20 to 29.
Williamson, W. Va., Mar. 30 to Apr. 9.
Chattaroy, W. Va., Apr. 10 to 19.

Generally speaking, electric cables are sheathed with lead for the purpose of excluding moisture and for the protection of the insulating material against mechanical or other injuries. It is sometimes necessary to harden and strengthen the lead sheath by the addition of 1, 2 or even 3 per cent. of tin. It is a question among engineers as to whether much is gained by this alloying, since the two metals do not mix uniformly, and in consequence, when much tin is employed, hard or brittle sections may develop, due to the segregation of one of the metals.

The Labor Situation

SYNOPSIS—The miners' officials finally consented to arbitrate the eastern Ohio strike. The coal companies are not disposed to concede the straight run-of-mine scale, formerly offered, believing a slack differential desirable and wholly legal. John D. Rockefeller, Jr., meets some of the officers of the United Mine Workers of America at his office. John R. Lawson and John Mitchell testify before the Industrial Relations Commission. A strike occurs in the anthracite region.

The operators' committee and the representatives of the United Mine Workers of America held a conference in Cleveland commencing Jan. 29. The meeting was called by the federal investigators and they participated in the session. On Saturday, Jan. 30, they adjourned till Feb. 2.

The operators, at once, offered to arbitrate, believing their case so just that they could not fail to receive a favorable decision from just arbitrators. The miners at first refused to submit the matter to any such test, stating that they refused to accept less than 47c. for machine-mined run-of-mine coal. The operators have withdrawn their offer of 44.61c. for that grade of coal, preferring to pay 58c. for lump and 22c. for slack, that being the equivalent of 44.61c. for run-of-mine and putting a premium on careful mining.

All Manner of Arbitration Proposals

After the miners had refused to accept the federal investigators as the sole arbiters a plan was submitted by the operators providing for five arbitrators, the operators choosing two, the miners two, and a fifth to be chosen by the other four. Another scheme included the two federal investigators, a seventh arbitrator being selected by the other six. None of these plans were acceptable to the miners.

The tentative arrangement for arbitration roughly gives the miners three representatives and the operators, the same number. Three other arbitrators are to be appointed by Federal Judges Killits of Toledo and Clarke of Cleveland. The miners refuse to let Hywel Davies or Daniel J. Keefe be members of the board.

The international officers of the miners' organization at first took no part in the negotiations, and they appeared opposed to the principle of arbitration as desired by the operators and the federal investigators. They have placed themselves under an obligation to the other operators with whom they made an agreement under which they promised not to settle with the eastern Ohio operators for less than 47c. per ton. This promise they regard as sacred, but they also pledged themselves not to concede a lump-coal scale in the Pittsburgh district and to be content with an equivalent of last year's scale in eastern Ohio but apparently they do not regard themselves bound to submit to these latter pledges. They regard them as having an inferior order of sanctity.

The Mines Are Not Working

Few mines are being worked. The Robey-Somers Coal Co. was employing about 100 men, and the tonnage was steadily increasing but on Jan. 30, the mine was closed pending the results of the federal investigation.

The Bradley mine of the United States Coal Co. is working, for the most part making the preliminary improvements necessary to prepare the mine for more extended operation. Several mines are cleaning up so that they can operate after the federal investigation is completed or the arbitral award is made, either agreeably to the decision if one is reached or "open shop" if no result is attained.

One of the eviction notices has been decided null and void on a technicality. In another case Justice Young decided for the defendant against the Robey-Somers Coal Co. where no technical error was alleged. The company declared it will proceed to evict miners who refuse to work in its mines under "open shop" rules but probably the arbitration which is now assured will delay any such action.

About 40,000 pairs of shoes have been delivered to the miners by the Union. They were purchased from a firm in Newark, N. J. It has been discovered that they do not bear the union label, and some of the miners' families though desperately in need of shoes are considering seriously whether "scab" shoes should clothe the feet of stalwart unionist miners.

Testimony of J. D. Rockefeller, Jr.

On Jan. 29, John D. Rockefeller, Jr. concluded his three-day testimony relative to his attitude toward labor, his relations toward the Colorado Fuel & Iron Co., the Colorado situation, and the Rockefeller Commission. He made a good impression but it cannot be said he helped the case for the Colorado Fuel & Iron Co. or the Colorado operators, because while he declared for certain principles of action, he was unable to show that these were being followed by the persons in control in the field. His frank admission that he did not know was, however, quite generally accepted.

The representatives of the miners, John R. Lawson, F. J. Hayes, Edward L. Doyle and Mother Jones seemed quite hopeful that John D. Rockefeller, Jr. was preparing to write to J. F. Welborn demanding that he recognize their union and make collections for it. Mother Jones' rapturous references to John D. Rockefeller, Jr. whom she declared she had once called "a burglar," appeared in all the papers. But the next day these worthies called on Mr. Rockefeller and Mother Jones had much to say about mere "lip-service to democracy." John R. Lawson appeared before the Commission and with unquestioned eloquence condemned Mr. Rockefeller, his commission and his capital. Somehow his statement failed to convince and was not received as well as Mr. Rockefeller's testimony.

The press will henceforth be more friendly, because the reporters have been admitted to the Rockefeller sanctum. No matter what he said, they have been appeased. After all in the past, absent treatment is what has been galling them, for the reporters and editorialists are too old in the profession to believe the fairy tales so cheerfully told them by the socialist press. But no good result will come out of the "rapprochement" between the agitators and Mr. Rockefeller. He will not help them and they know it.

John Mitchell's testimony was somewhat difficult to follow. He like many other people has been dreading large corporations. He stated that they reduced wages. This has never been the experience. They have repeatedly raised prices but they invariably pay higher wages than smaller corporations in the same district and provide better working conditions. It is true they could depress wages but they do not do it and since large corporations have come into being we do not have reductions in wages every time there is a lull in business as in the past. This stability is due to the action of the larger companies. As the strike in Colorado was not really about wages, it was a folly for John Mitchell to declare that the miners thought they might as well "starve idle as starve working."

Aristocracy in Laboring Men

The Dauphin County court in Pennsylvania has decided in favor of James E. Roderick's ruling that all men are eligible as mine foremen who, having had five years' experience in the mines, prove competent on examination for the place. The attempt to restrict the position to those who have dug and shot coal at the face for five years has therefore failed completely. Judge McCarrell, of the Dauphin County court, has declined to hear the 15 exceptions made to the ruling. The rule dismissing the case has been made absolute.

The attempt to make the office a place of special privilege for those who have been miners has fortunately failed. The United Mine Workers of America which has always most commendably stood for all the workingmen around the mine did ill to act on behalf of a few instead of all its members. James Matthews, president of the Ninth district by his suit against the head of the Department of Mines of Pennsylvania endeavored to establish what was an aristocracy of mining labor.

Union Buttons in Anthracite Region

On Jan. 26, the Lehigh Valley Coal Co. is alleged to have ordered the men away from its Franklin colliery who were examining the miners to see that all wore union buttons. The men left, but 600 men and boys went on strike. On Jan. 25, the executive boards of five Pennsylvania districts of the United Workers of America assembled at Harrisburg to discuss legislation relative to workmen's compensation and child labor.

The Federal court in Arkansas has ordered Andrew S. Dowd, the receiver in succession to Franklin Bache to sell the Bache-Denman Coal Co. properties. Mr. Dowd says that a deal to sell the coal lands and mines to the United Mine Workers of America has been under way for several weeks but has not been completed.

Central-Station Power

By Wilfred Sykes*

SYNOPSIS—Many contracts for central-station power are unfair. Such agreements to be equitable should be composed of three elements: A fixed charge depending on the peak load, a flat rate per kilowatt-hour and, if power-factor is a consideration, a limit should be fixed, a high value receiving a lesser charge per unit of power while a low value should be penalized.

It is not uncommon for an electrical engineer to be asked to recommend apparatus for a mine purchasing electric energy which will enable the power costs to be reduced in some way or other. An analysis of many such cases has shown that almost invariably the power contract is defective in some respect.

Many of the contracts in force embody clauses that require the purchaser of power to use apparatus that is neither the cheapest nor the most economical that might be used. Undoubtedly much of this trouble is due to the fact that proper attention has not been given either by the purchaser, or by the central station, to the best form of agreement.

There has been a marked improvement during the last few years in contracts made by large central stations, but in general, there remains much to be desired. The purchaser is also to blame for not giving the subject proper attention. Where a man will carefully investigate the relative merits of the different makes of apparatus involving an outlay of say $1000, a power contract involving an expenditure of $10,000 to $20,000 per year will be signed without receiving much thought. Often the purchaser feels that he is not competent to understand this contract or to pass upon it, and the verbal explanations of the power salesman are accepted. Such a proceeding often leads to misunderstandings and disappointment to the purchaser.

The basis of all contracts must be that they are mutually advantageous and, consequently, just to both parties. The central station must receive an equitable return for its operating expenses, the overhead charges of the apparatus required to furnish the power, and a fair margin of profit. No contract that penalizes the purchaser for poor operating conditions due to other customers or for bad engineering of the central station is fair, but unfortunately in some territories such contracts are in force and increase the cost of power to the purchaser without any proper return.

The general basis of power charges is usually fairly well understood by large purchasers, and most operators appreciate that their costs may be roughly divided into two groups. First, those including fixed charges such as distribution, interest, and amortization, and second, the operating charges such as fuel, stores, labor, etc. In many cases such items as line maintenance, etc., might be included in the fixed charges, as they are practically independent of the load on the equipment. That some system of charging, taking this fact into consideration, is the one that will give the lowest cost to the purchaser and will also be fair to the central station is quite clear.

It is clear also that the central station can give a lower rate as the price paid for the power varies approximately as the costs, and it is therefore possible to determine more accurately what will be received from any given business. If a flat rate is made it must be set at such a value that the average load factor of the system will be profitable. Consequently, purchasers of large amounts of power cannot be given any better rate than those requiring a small amount during only a short period.

It is immaterial whether the power is generated in a central station and distributed to a number of customers, or whether each of the customers has his own generating plant, the power cost will be made up of the same items. Little power is now sold on a flat rate as it is recognized the best prices cannot be given with a charge which does not adapt itself to varying conditions. A flat rate is usually adapted for only small customers and for lighting.

Various schemes have been gotten up to give power rates which vary approximately as does the cost of power, but it is only during the last few years that anything approaching a proper basis has been devised. This has been mainly due to the fact that there has been no apparatus available to accurately determine what the charge for power should be, although it has been recognized for a long time that a proper basis of charging is one that involves a fixed amount depending upon the demand on the central station, and a variable charge depending upon the number of kilowatt-hours consumed.

The only way in which the amount of power-station equipment that is required for each customer can be determined is by keeping some record of that customer's load conditions. There is considerable difference of opinion as to what is a fair basis for determining the amount of apparatus needed for certain customers. It is generally conceded that an integrated peak, or in other words, the average load for a certain period, say 5 minutes, is the proper basis. The period varies widely, some stations taking the average peak for one minute, others 5 minutes, 15 minutes, or 30 minutes.

Still another arrangement is to take the average of say 6 of the highest 5-minute peaks during the month. One-minute peaks are hardly fair to the purchaser as a peak of such short duration does not fix the capacity of the apparatus that must be used. If, however, the rate is such that the amount of equipment that is considered reserved for the customer is, say, two-thirds of that indicated by the peak, or some other percentage that is approximately correct and the rate is made accordingly, then there is no objection to a peak of this duration being used as a basis for charging.

If a 5-minute peak is taken, the capacity of the apparatus reserved, of course, is nearer to the value indicated during this interval. In general, however, a 5-minute or longer period works out more satisfactorily for everyone concerned than does a shorter one. Instantaneous peaks are the basis of charges in some cases, but are generally unsatisfactory due to the difficulty of measuring them,

*Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

and also of making proper allowances for abnormal peaks, for which the customer is not responsible.

It is the load that must be carried for, say, 15 minutes, or half an hour, that really determines the capacity of the generating plant, and therefore the proper basis for charging is one that takes this point into consideration. In other words, the average, or integrated, peak load for a reasonable period must be used. The period taken is, generally, 15 minutes to half an hour; the larger power stations adopting a longer period, as the variety of their load enables them to take a more liberal attitude towards the customer than is possible with a smaller plant.

To determine, to some extent, the effect of the length of the integrated peak upon the basis of charging, a number of investigations have been made, and the results of one case are shown below.

Taking the 15-min. peak as a basis, the 5-min. and 10-min. peaks are given as a percentage:

15-min. peak	100	per cent.
10-min. peak	104	per cent.
5-min. peak	106½	per cent.

It is usually not possible to arrange the fixed charge that a large customer pays so that it will cover the total fixed charges of the station that would be represented by the capacity measured on, say, a 15-min. integrated peak, as the charge would be so high that it would be difficult to secure business.

It is usually easy, however, to obtain a fixed charge that would be equal to the corresponding figure if the customer installed his own station, which he could do, generally, at a lower cost per kilowatt capacity than the central plant, as he would have considerably shorter lines, and the standard of equipment probably would not be so high.

The additional flat rate per kilowatt-hour is a much more flexible charge, and the average customer is usually prepared to stand for a flat rate that represents a fair profit, whereas the fixed charge must be reduced below what is really an equitable figure. Much of this difficulty is due to the fact that customers have, as a rule, little idea as to the proportion of fixed and variable charges in their power accounts, and therefore have not been educated to see these charges in their proper relation.

In the case of a large system, supplying power to both large and small consumers, the question naturally arises, should the large user pay the same rate as the smaller one? In general, it is reasonable for the large customer to expect a lower rate, as he looks on the matter from the standpoint of what he could do with his own generating plant, and this is a condition that must be met by the central station.

One point that is receiving more attention from central stations is the effect of power-factor on their lines and equipment. Power-factor determines the percentage of apparatus installed that can be usefully employed for delivering energy and the station has the right to expect that the customer shall maintain a reasonable operating power-factor.

Some central stations are attempting to meet this condition by regulations designed to control the type of apparatus used by the customer, but there are limits to this arrangement that reduce the value of the scheme. It is customary to require synchronous motor-generator sets to be used for direct-current work, and, as much of the power required by mines is for haulage, coal cutters, etc., fairly good results can be obtained by this simple expedient. But there are a great many cases where induction-motor load predominates, and a more definite scheme is required.

The only definite way in which this factor can be controlled is to fix a minimum power-factor below which an additional amount will be charged per kilowatt-hour. In some circumstances a bonus might be given if better power-factor is maintained. To obtain a better power-factor requires the expenditure of more energy in converting apparatus. This should be paid for by the station if it obtains any advantage therefrom. It is not fair, however, for any station to require a power purchaser to install apparatus which is more expensive in first cost, and less efficient in operation without some benefit in rate being given. A number of stations have attempted to control the apparatus installed by their customers in order to correct past errors, without giving the purchaser the benefit of a lower rate. Often such contracts appear attractive to the uninitiated.

A case recently came to the writer's attention where a central station with a long transmission line had induced one of the customers to install a synchronous motor-generator set having an extreme kv.-a. capacity in proportion to its kw. capacity, and which was to be used for correcting poor line conditions. As an inducement the power company offered to supply an attendant for the substation, and the arrangement was accepted by the customer without investigation. The net result was that the customer paid several times the amount of the attendant's wages for extra power.

In view of the above it will be seen that the following should be the basis for power contracts:

(A) A fixed charge, depending upon the integrated peak load for a reasonable period, so that it will represent, approximately, the equipment required to carry the consumer's load.

(B) In addition to the above, a flat rate per kilowatt-hour, based on operating costs, taking into consideration the amount of power used, and allowing a graduated discount so as to give large consumers a lower rate.

(C) If power-factor is a consideration, a reasonable limit should be set, lower power-factors being penalized by increasing the rate per kilowatt-hour, and a reduction in rate granted if high power-factor is obtained.

I believe that if this plan were generally followed, it would be possible to meet all the conditions arising in mining work, and to fix rates that can be given to all consumers that will represent profitable business.

In conclusion, it must be pointed out that to secure a proper load the central station should adopt a generous policy towards its customers, and when there is doubt as to the effect of operating conditions upon the station's costs, it should be prepared to accept the risk, rather than attempt to place a burden upon the consumer which may not be justified by results. The central station has the advantage of a diversity of loads, and a part of this benefit should be given to the consumer.

While tape and braided rubber wire and cables are used for indoor and submarine service with entire satisfaction without lead sheathing, experience has demonstrated the advisability of inclosing the cable in a sheath wherever it is used in conduits for underground work, or where it will be exposed to acids, gases, extreme temperature changes or other destructive agencies.

The Mine Foreman

"If every mine foreman were given a Carnegie medal for every act of heroism he performed, this plan would keep a factory busy turning the medals out," said Col. R. A. Phillips, of the Delaware, Lackawanna & Western R.R. Co.

There is a group of over 2500 men in the anthracite region of Pennsylvania who always look you straight in the eye. Big, burly chaps, they are, for the most part, and they range in age from 30 years to the term of life. They are the mine foremen and assistant mine foremen, each one of whom bears the responsibility for not only many thousands of dollars' worth of property, but for hundreds of lives.

The anthracite industry has been responsible for the development of this group of splendid men, but it would be a fairer way to put it that they have been largely responsible for the development of the anthracite industry. Occasionally a man who is unfit attains the position of mine foreman, but he does not keep it long.

The mine foreman must listen to the complaints of men of many nations; he must pore over mine maps at night to see where those needed extra cars of coal are to come from; he must control his men, and keep them from going into danger, and be the first to face a peril himself. He must be a leader of men.

The mine foreman must have the confidence of his employees and the confidence of his men. He must be a diplomat, a financier, an executive, a student, a disciplinarian and a philanthropist. On him depends to a large extent the success or the failure of an operation. By the general public, he is unhonored and unsung, but he is doing his job and doing it mighty well.

Electric Shotfiring in Bituminous Mines

By M. D. Cooper*

The employment of especially qualified men to fire shots in gaseous workings is intended to reduce accidents due to carelessness or ignorance on the part of the miners. It is self-evident that a person whose sole duty it is to fire shots after examining the place and determining that all the surrounding conditions are safe is much less liable to cause an accident than one whose main duty is to load coal, and from whom, therefore, the firing of an occasional shot is of secondary importance.

The Bituminous Mine Law of Pennsylvania requires that "in such portions of a mine where explosive gas is being generated in quantities sufficient to be detected by an approved safety lamp, in which locked safety lamps are used, the mine foreman shall employ a sufficient number of competent persons who are able to speak the English language, to act as shotfirers, whose duty shall be to charge, tamp and fire all holes properly placed by the miners and to refuse to charge any holes not properly placed." The same law further provides that all such holes shall be fired by an electric apparatus, and no person other than the shotfirers shall connect up the wires or operate said apparatus.

The advantages of electric firing make for greater safety than where fuse or squibs are employed. No open light is required where electric current is used, and the danger of misfires is considerably lessened. Again, the burning through of fuse, with its consequent dangers, is avoided by the use of electric detonators. Moreover, the shotfirer may locate himself in a safe place before firing the charge.

For the purpose of firing shots electrically, a small hand generator or blasting machine may be used, or in place of this, a box containing two dry cells may be satisfactorily employed where it is necessary to fire but one shot at a time. Blasting machines of various types may be purchased from the manufacturers of explosives. On the other hand, a safe battery box may be home-made.

Details of a Simple Shotfiring Box

A convenient, cheap and easily constructed shotfiring box is shown in Fig. 1. This apparatus consists of two ordinary dry cells, a small steel spring, a contact plate, two binding posts, and a box made of ½-in. boards,

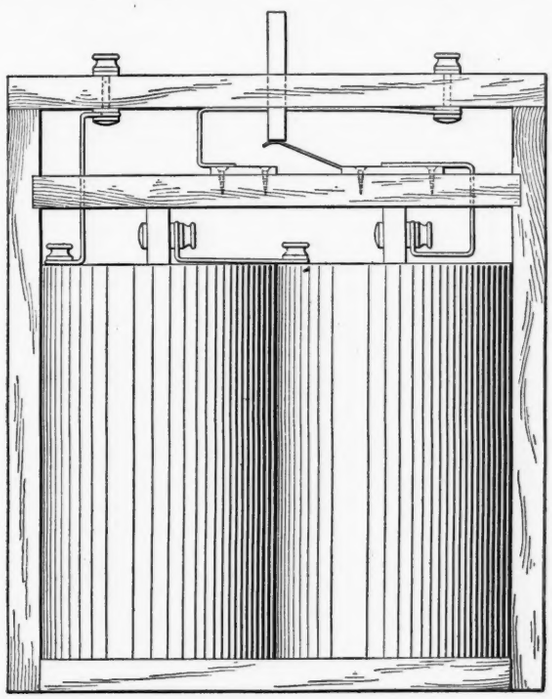


Fig. 1. Shotfirer's Battery Box with Front Cover Removed

to which a shoulder strap may be attached. To operate the apparatus, the battery wires are first connected to the wires of the detonator, and then to the binding posts of the battery box. After this a wooden plug, of sufficient length and of the proper diameter to make a snug fit in the hole provided for the plug in the top of the box, is pressed down to bend the spring into contact with the contact plate. In this manner the circuit is closed and the shot fired.

With this apparatus, it is found that a shotfirer can set off an average of 50 shots in eight hours under normal conditions of working, where the distances between shots are not excessive. The life of the batteries varies, but in general a pair ought to last 150 days, which is equivalent to 7500 shots. The wires used to connect the battery to the detonator wires are made up of two separately insulated wires, No. 14 B. & S. gage, covered by an outer

*Mining engineer, Ellsworth, Penn.

insulation binding both wires together. Its life depends entirely upon the manner in which it is used.

If, after firing, the shotfirer drags the wire toward him while coiling it, it may be rendered unfit for service in about two or three weeks. However, if he walks toward the place where the shot was fired while taking up the wire, thus avoiding unnecessary wear, it will be found that it will be safe for use, in some cases, for a year. After the insulation becomes worn, so that any part of the wire except at the ends is exposed, the insulation must be repaired, or the wire discarded on account of the danger of a difference of potential between the bottom and the rails on which the wire may rest.

A lighter apparatus than that described above may be made by substituting for the two standard dry cells a single battery of three units, such as that used in a small cylindrical flash lamp. This arrangement, however, is somewhat more expensive.

In order to have some definite record of the work of shotfirers, and to provide a means of increasing the efficiency of their work and equipment, each shotfirer ought to fill out and hand to the mine foreman a daily report on a blank similar to that illustrated below:

SHOTFIRER'S REPORT

....., 19..

Mine No. .....
Section No. .....

1. Before charging each shothole, did you examine the place for all dangers?.....
2. Total number of shots fired .....
3. Shots I refused to fire:

	Location	Reason
1.	.....	.....
2.	.....	.....

4. Blownout shots:

	Location	Reason
1.	.....	.....
2.	.....	.....

5. Misfires:

	Location	Reason
1.	.....	.....
2.	.....	.....

6. After firing, did you return and examine each place where a shot was fired?.....
7. Remarks .....
.....
.....

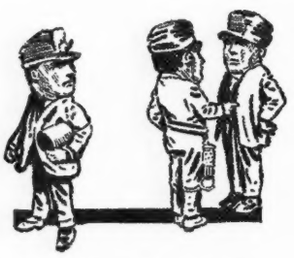
Shotfirer.

When It Pinches

Written Expressly for COAL AGE
By BERTON BRALEY

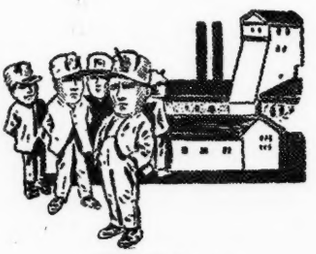
WHEN the breaker's running steady
And the trade's O. K.
We've got our grievance ready
All along the way,
We do our daily mining
With an ugly frown,
But—we sure do miss the money
When the mine
shuts
down!

IT'S not a picnic mining
'Way below the soil,
Where the sun is never shining
On your hard day's toil,
But it buys you food and clothing
And the wife's new gown,
And—you aren't so keen on loafing
When the mine
shuts
down!



THE *pitboss makes us weary and the foreman, too.*

WHEN the hoist is jerking cages
And the payroll's strong,
We blow a lot of wages
Just for wine and song,
We treat the other fellows
And we do things brown,
But—we sort of wish we hadn't
When the mine
shuts
down!



WHEN *the mine shuts down.*

OH, the pitboss makes us weary
And the foreman, too,
And we're always sort of leary
Of the things they do,
We talk about them nasty
All around the town,
But—we find we're *longing* for 'em.
When the mine
shuts
down!

THERE are grievances in season
Which are just and fair,
But we ought to keep in reason
While the job is there,
For when trouble's really busy
Why, she does things brown,
And you're pretty sure to meet her
When the mine
shuts
down!

Editorials

Not To Inform but To Confuse

The New York *World* gives the following apocryphal account of the termination of the Colorado strike:

Nothing in all of the testimony of John D. Rockefeller, Jr., was more illuminating than his description of the manner in which the great Colorado strike came to an end.

The employees were invited to elect delegates to meet the executive officers of the employing company in Denver, and did so. At this conference the spirit manifested on both sides was "most satisfactory," and it is Mr. Rockefeller's hope and belief that from this meeting will develop some permanent machinery which will insure to employees quick and easy access to the executive officers with reference to any grievances, real or assumed.

If there had been such access a year or two ago, it is probable that there would have been no strike.

How easily these things can be done when there is a real disposition to do them!

Our readers will recall that Mr. Rockefeller stated, as we printed last week, that the strike ended on Dec. 10, 1914, that the call for a joint conference between the employees and the company was not made till Jan. 5 of this year, and that the meeting was not held till Jan. 19. In this conference few if any of the strikers took part. Only those employed by the Colorado Fuel & Iron Co. were represented, and that corporation had reinstated but few of the striking men as their mines were already almost completely supplied.

Moreover the Colorado Fuel & Iron Co.'s men do not by any manner of means comprise all the striking miners of Colorado. The surrender of the union was not to that company alone but to several others and covered at least one important district where the "Fuel Company" does not even have a mine.

Would it be too exacting if we were to ask the editorialist of the *World* to read the columns of his own paper, and thus avoid adding to the confusion of thought already prevailing relative to the Colorado situation?

A Congressman on Feudalism

Congressman David J. Lewis recently made some interesting statements before the Federal Industrial Relations Commission. We have quoted them on another page. He showed how naturally the coal operator became landlord, merchant, doctor, and even saloon-keeper for the miners under his employ. He then said that this was unfortunate because when the employee fell out with the operator, he was at war at the same time with the man who not only paid him wages, but housed him, sold him food and clothing, provided him with medicine and even with beer. The employee by the fact that he had quarreled with one man, became an outcast without a friend.

Now Congressman Lewis' statement has only a small relation to the truth. In a big city, say Minneapolis, where the happy people are not cursed with mine operators nor injured by their feudalistic tendencies, when a man is discharged by his employer, he is evicted by his landlord, refused food and clothing by his storekeeper and he cannot get his "growler" filled by the saloon-keeper. He can, however, usually get care at the dispensary. But this is a small mercy and so the plight of the jobless is terrible. On the other hand, in the feudal mines of eastern Ohio, the men have lived in the companies' houses for ten months without paying rent, and only now, at last, are the men about to be evicted.

Public opinion is much wrought up about the proposal to dispossess these men. The feudal barons of eastern Ohio are subjected to most severe criticism for doing after a year what the average landlord would do in a month with but little criticism and almost no resistance.

We do not know just what credits the company commissaries in Ohio may have given during the strike. Perhaps they refused entirely to give any supplies to the men without immediate money payment, but we do know that in many places commissary stores have on occasions financed strikers against their companies by letting the employees of the corporation have goods on credit.

In the 1894 strike one company, after it had given all the credit which it felt justified in extending, actually let the miners take the commissary mules and wagon to make house-to-house trips for contributions. The store manager, while he could not advance any more goods, did not want to see the women and children go hungry. So he furnished the wagon. It would hardly be done today, for the farmers are no longer sympathetic, knowing that the miners who are striking make more than the farmers even when crops are good; so sending out a wagon to the neighboring farmhouses would not be of any avail.

To show that in the matter of medical attention the companies' rule is not altogether undesirable from the point of the miner, we will relate a recent incident. We strolled into a superintendent's office and noted that a little box of money was brought to him which he passed out to miners, who occasionally appeared at the window and presented slips.

On inquiry we learned that there had been a strike lasting a month; the company doctor continued his ministrations as before, and the clerk when he made up the first payroll after the strike was over, deducted from each man the pay due the doctor for his services during the strike period.

But another strike was threatened by the union if the money was not returned. The employees had been idle, and though the doctor had been working, they contended that he should be contented to lose his pay just as they had theirs and should be willing to donate his medicines into the bargain. The company had been obliged to deprive the doctor of his dues in order to pacify the union.

These evidences of the benignity of feudalism are all we will now offer. We will not say anything about the saloon. We fear to do so because we are prone to believe that if an operator were wicked enough to run a saloon he would be base enough to break his beer pump if his miners went on strike. However, we only know of two cases where saloons were run by company officials, and we know that in those instances the company was not a party to the business and had no ownership in the building.

Despite all we have said, however, in defense of the industry, we agree with Congressman Lewis that if the United States were all feudalized like some mining towns, it would be an unfortunate and an un-American situation. Justified and endurable or not, the operators should endeavor to correct that condition, for it is well that men should control their own actions and mold at pleasure their own lives.

Nevertheless his conclusions need not be taken too seriously. He is merely pointing out that a local condition if made universal would be unbearable. Some individuals own property; it would be unendurable if one man owned it all. But that is not sufficient to condemn private ownership.

But if Congressman Lewis really believes the water of feudalism may become a deluge, let us assure him that like the oceanic area its limits increase and decrease so as to make little change from year to year. It is true that recently the companies have increased feudalism in Kentucky by collecting for extra school terms, in the anthracite region by levying a contribution for the priests and in many sections by holding back pay for the hospital. It is also true that large sums of money are held back by those feudal barons and paid over to the union and in many places this is done whether the employees really desire it or not.

But against these lapses into feudalism, we may instance the increase in private home ownership from one end of the country to another, especially in the Middle West and the gradual decline of the company store. Where the latter exists, it is greatly improved and usually the best store and most reasonable the neighborhood affords.

In conclusion, let us remark that Congressman Lewis acknowledges that feudalism has an element of inevitability. Might we not also ask him to grant that in its care of the workingman it has even more the quality of benignity? In fact, its extension of late years has been perhaps wholly in that direction.

As evidence that feudalism as denounced may be benign, let us call attention to the fact that Henry Ford is declared to be feudal in his relations with the employees in his celebrated automobile factory. In fact, the feudal attitude always was truly protective and the creed of the uncompromising anti-feudalist is "the immortal rhetoric of Cain." We are harried back and forth between the contemners of the saying, "Am I my brother's keeper?" and the propagandists who demand "Who made thee a prince and a ruler over us?" Thus, the capitalist runs the gauntlet and it is a poor fool who cannot plant an effective blow on his head.

Domestic Coal Consumers Economizing

Retail yards in the factory towns all over the country complain that the domestic consumption is much less than in former years. Many householders allow their fires to go out over night and only burn coal during the day time for cooking and heating purposes. Other families have been disbanded and are living with relatives, and the net result in every case is that there is one less household consuming coal. These are some of the reasons why the retailers still have an accumulation of coal left over from shipments of last summer and fall, and explains their failure to place orders appropriate to the season.

The Dream of Conservation

This is an age of dreams and dreamers, but modern man dreams upon his feet with both eyes open. And, unlike the mental visions of the past, the thought-image of today not infrequently materializes into reality, crystallizes into wood and steel, brick and reinforced concrete, into better physical or moral conditions, into labor-saving devices or cheaper necessities; in short, into those things which in one way or another make life more worth while.

The conservation of natural resources has been a dream. Its realization has begun. True conservation is, however, composed of two elements, one of which affects production, while the other affects utilization. Wherein lies either the equity or logic of forcing a coal operator under pain of fine or other punishment to extract the last ton of coal from a given measure, allowing the consumer meanwhile to waste as much of the heat content of the fuel produced as suits his fancy?

Some of the mining methods and practices in vogue in this country have been, and are still, highly reprehensible and should by no means be condoned. The percentage of extraction attained in many mining districts may be woefully, aye criminally low, but the profligacy of even the average consumer in his utilization of the heat contained in this fuel vastly exceeds the waste of the producer.

Nor are the means entirely lacking whereby to secure a greater return in heat absorbed for the fuel-capital invested, as is shown by Mr. Van Brunt, of the Combustion Engineering Co. of New York, in our current foreword. He points out that the proper equipment installed under mine boilers allows the utilization of fuel, which but a short time ago was considered purely and solely as an unavoidable waste.

And if equipment, scientifically designed and constructed, will turn a loss into a gain, if it will enable the consumption and utilization as power of a waste product, which otherwise must needs be disposed of at an expense, a long step has been taken toward true conservation.

The conservation of our vast natural stores of fuel has for some time been a favorite theme among dreamers with political proclivities. These have secured, or procured, legislative and congressional enactments concerning coal lands in the public domain, which have masked as beneficent, but which have nevertheless failed utterly to either materially enrich the public coffer or reduce the price of fuel.

It has remained for the practical dreamer—the one who puts his vision into wood, steel, copper, brick, or concrete—to develop just such devices as that mentioned in our foreword, and to conserve, not the coal in the ground, but to render available a higher percentage of the heat which it contains.

The progress of the world demands the efforts of both kinds of dreamers. True conservation—which is only another word for thoroughness—will be attained so far as the fuel industry is concerned when the percentage of extraction from the earth and the heat absorption from the coal are each a maximum. The dream of the conservationist may eventually be realized—we are on the right road. But when it finally meets fulfillment, it will be found to be composed of two parts equally important—conservation in production, and conservation in utilization.

Success

In our Jan. 2 issue we announced a special "Success" number of COAL AGE as a coming feature that would doubtless be of unusual interest. Since publishing this preliminary notice, a number of excellent articles, well adapted for such an issue, have been received, and as a consequence we are more than ever certain that our readers will all help to make this particular number of COAL AGE the biggest and best issue so far published.

Arrangements have been made, therefore, to print the special "Success" number of COAL AGE on Apr. 3, and we invite the active participation of all our readers. Every article prepared for this particular issue must bear closely on the subject success, although it may deal with a man, a machine or a method.

One article already received tells of a man who came to this country a poor emigrant boy, and the writer of the article (an acquaintance of the fellow) recites the story of this man's struggles to climb to his present position as mine superintendent. Perhaps you know a similar case; if so, write it up and send it to us.

At the mine where your interests lie perhaps there is a fireboss, or foreman, or other official, who, in proportion to his opportunities, has made a greater success than the president of the company that employs him. Maybe the man you have in mind has had no chance to secure a schooling, and, notwithstanding this severe handicap, perhaps he has afforded his children an education, and in addition has paid for the home he lives in. That's a story worth printing.

Then there's the case of a mine where failure has been turned to success by the adoption or application of a new method of working, or by the installation of certain types of new machinery, or maybe some new efficiency plan has saved the day. Nothing could be more interesting.

In order that all who desire to do so may prepare something for this special number, we have decided to limit each contributor to one article. If you don't want to send us something yourself, tell us what you would like to see written up in this special issue, and we will try to follow out your suggestion. Remember that your name doesn't have to appear with the article you write.

Just think! is there anything so close to our hearts as that magic word "success"? Is there anything easier to talk about? Is there anything more interesting to read about?

Pick your subject and start your article today. Get it in our hands as soon as possible, so we can set it up in type and return it to you for correction and revision.

Letter No. 1 Wins in the Contest—Who Gets the Promotion?

After a competition that was interesting in the extreme, the readers of COAL AGE by a large popular vote selected Letter No. 1 written by J. E. Butler, general manager of The Stearns Coal Co., Stearns, Ky., as the winning answer to the cartoon—Who Gets the Promotion?

There was an enthusiastic response to our invitation for a popular vote, readers in all coal states sending in their choice by letters and postals. In one instance, a single large company operating a number of mines submitted 18 votes. There is every evidence that the question was discussed in detail in all fields. Quite a few people stated their choice of the three men up for promotion, but did not select one of the nine letters; these answers, of course, could not be counted.

The second most popular letter was No. 9, written by M. D. Cooper, a mining engineer of Ellsworth, Penn. Mr. Cooper ran Mr. Butler a close race, and early in the voting was slightly in the lead.

Letter No. 3 by Leo Mayer and Letter No. 6 by A. W. Calloway were always in the running, and each polled a large final vote. In fact, each one of the nine letters published had its friends and received many votes, showing how difficult it would have been for a few judges to reach a popular decision in the matter. It also occurred that a number of readers stated as their opinion that certain letters not printed among the nine were more meritorious than any of those up for vote. These same readers, however, in their actual voting confined themselves to one of the nine letters.

A careful analysis of the votes received indicates clearly that prejudice, or rather personal opinion as to which man should be promoted, played an important part in influencing each man's choice. If a reader believed that the older man of long service should be promoted, he voted for one of the letters advancing the same view. If he was in favor of promoting the "popular" man, he generally chose for the winning letter one holding views similar to his own. For this reason the final result means a little more than that Mr. Butler wrote the most convincing letter. It means also that Mr. Butler was running on the popular ticket, for there is no doubt that the young "popular" man was the choice of the majority.

A great many letters have been received from COAL AGE readers, complimenting the paper on having advanced such an important, and at the same time, such a happy question for general discussion. An official of one of the largest Southern coal consolidations says that the effect of this cartoon discussion will be felt for a long time in many camps. Men who have been honest and industrious have been brought to realize that there are some traits of character worth cultivating besides industry, loyalty and persistence. They know now that a great many people figure a pleasant countenance and a sociable manner as assets of great importance in a business sense. Therefore, if the discussion has brought more smiles to the faces of many ambitious mining men, the work has been worth while.

It should not be difficult now for those who are seeking promotion to set before themselves an ideal and endeavor to pattern their lives therefrom. Ever so many letters have suggested that from this discussion we evolve an imaginary being who would fill the bill in every particular. One of our readers in a lighter vein says: "The cartoon problem would have been much simplified by the addition of a fourth applicant, who was 'some kin by marriage to the boss' wife.' Then specify in addition that the kin, the wife and the boss are all Irish, and the job is a cinch for the relation."

Discussion By Readers

Mining Laws, Legislation and Mine Regulations

Letter No. 26—It is indeed gratifying to see the great interest that has been manifested in this discussion. If you will allow me the space, I want to emphasize a few of the points already submitted. One of these is in respect to systematic timbering in mining.

It will be remembered that, about two years ago, the qusetion of systematic timbering at the working face was thoroughly discussed in COAL AGE (Vol. 3, p. 286, *et seq.*). If I remember rightly, it was generally agreed in that discussion that a maximum distance between posts set at the working face should be maintained, generally. At that time, it was urged by Mine Foreman William Crooks that legislation was greatly needed to regulate the question of timbering in coal mines (Vol. 3, p. 698). I gladly indorse that suggestion and maintain that a large number of mine accidents occur from falls of roof at the working face, which would be prevented if state mining laws required the adoption of some regular system of timbering the coal face in every mine. I believe such a law would be of great assistance to all mine managers, foremen and their assistants.

I desire, also, to indorse Mr. Crook's remarks, COAL AGE, Nov. 21, p. 839, in respect to the time that should elapse between the inspection of working places by the fireboss and the miners starting work for the next shift. I agree with Mr. Crooks that no more than *two hours* should elapse between the time of making such inspection and the time when men are permitted to go into the mine. This is an important matter that should be plainly treated in all mining laws.

Considering the constant recurrence of mine disasters and the number of mines that have been visited by two or more explosions, the suggestion is worthy of the most careful consideration that state mining laws should compel the introduction of safety lamps in every mine where it is known that quantities of firedamp are generated. By this I mean the exclusive use of safety lamps should be made compulsory, by law, in all mines in which gas is generated in such quantities as to necessitate the frequent marking out of certain places because of the presence of sufficient gas to make the place unsafe for work.

The mining law should further require that every person employed underground, in such mines, should be taught the use and care of safety lamps. The same requirements should be made of shotfirers who are frequently compelled to carry safety lamps in the performance of their duties. I have known instances where men employed as shotfirers and obliged to carry safety lamps knew little more about the use of the lamp than how to light the same. Under such conditions, it is no wonder that mine explosions occur.

Before closing, I want to refer briefly to the question of the *selection of mine inspectors.* It seems to me that a better method of choosing men for this office should be generally adopted. I would ask, What is the use of men fitting themselves by careful study and hard work to fill such positions when appointments to this office are given out merely for political reasons and in return for the political services of men who are ill-prepared for the work of inspecting mines? There can be no question but that every effort should be made, and *must* be made, to secure the men best fitted by knowledge and experience for this responsible position. The question has well been asked, "Does the present method of selecting men for this office accomplish this end?"

There are many points, besides, that could well be discussed, in the consideration of our mining laws and needed legislation, and I hope these points will be brought out by others who will enter this discussion.

A. COATS,
Mine Foreman.

Kimberly, Ala.

Letter No. 27—I am pleased to see the great interest that is being manifested in this discussion. I read with some surprise the criticism of my last letter, by Mine Inspector Rose, of Tennessee (COAL AGE, Jan. 2, p. 25), who seems to refute the idea I expressed that the present method of appointing mine inspectors, in some states, is unsatisfactory. Mr. Rose's letter contains two points that I will answer.

1. He asks, "Is it not true that most men holding positions of trust and honor have secured those positions through influence?" Mr. Rose charges that I "do not suggest a better method for the selection of mine inspectors," in answer to which I will narrate, briefly, a few observations I have made, during the past few years, when my spare time has been taken up in teaching the principles of mining and preparing men for state mining examinations. I will say that many of these men have been successful in passing the examination, and are now holding positions of trust and honor. I might add that they did not "secure these positions through influence"; but obtained them by reason of their practical and technical training.

Permit me to ask, What kind of men are selected generally by large coal corporations, for positions on their official staff? Are men selected for these positions because of any "influence" brought to bear; or because of the ability of the candidates to deliver the goods? I venture the assertion that any shrewd mine manager will desire to know something of the candidate's capability before making him mine superintendent or foreman of his mines. It is *ability* and not *influence* that counts as a commercial asset. As an instance supporting this assertion, I recall a man who, nine years ago, was one of the rank and file in Alabama. Today, he is general superintendent of a large coal company. His rise was phenomenal; but it came as the result of his *ability to get results.*

Permit me to ask Mr. Ross, Why does the U. S. government hold civil-service examinations? Is it not to test the knowledge of applicants for the positions to be filled? Such an examination is necessary to produce

qualified men. It is stated in Bulletin No. 1 of the University of Illinois that "One of the most important and prominent topics under consideration by the industrial and educational world, at the present time, is what is known as Industrial Education; that is, such education and training as will produce more skilled workmen and better foremen and bosses." I fully indorse this statement.

In reference to the appointment of state mine inspectors, Mr. Rose says:

I fully believe that the appointment of mine inspectors by the governor is the best method that can be adopted in the interest of safety for the miner.

I trust Mr. Rose will bear with me for my failure to see any logic in a statement of this kind. Suppose, for a moment, the governor of a coal-producing state is, we will say a cotton manufacturer and knows little or nothing of the coal-mining industry. In this event, he must rely, naturally, on the advice of friends and is easily susceptible to the political influence of those who have supported his campaign for office.

In response to Mr. Rose's charge that I did not suggest a better method of selection, I would say, Make the appointment of state mine inspectors, by law, dependent upon and determined by a competitive examination. The candidate whose technical examination shows the *highest percentage* and who has had the necessary *practical experience* in the mining of coal should be recommended for appointment by the examining board, the members of which should all be mining men of experience and have sufficient technical knowledge to enable them to pass intelligently on the questions required to be answered by candidates. To my mind, this is a practical suggestion, and points out, I believe, the only sane way to safeguard mine employees. In forming my conclusions, I have tried to cultivate an unbiased opinion in respect to what I believe would go a long way toward placing the mining industry in a less dangerous class of occupation. I do not wish to appear as the man, who, looking through a dark glass, saw everything dark. I want to view things in a practical and helpful light.

WM. CROOKS.

Ensley, Ala.

Letter No. 28—One of the most important considerations, in the discussion of mining laws and needed mining legislation, is the question of the selection of state mine inspectors. I believe that it is quite generally agreed that the mine-inspection department, of all others, should be under civil-service control. This plan seems to have been followed in most coal-producing states. Viewed from the standpoint of the mine workers' organization, however, the system has the disadvantage that it places the mine-inspection service almost beyond the control of any outside influence, either political or otherwise.

The mine-inspection service in Illinois had been, for many years, practically free from the untoward influence of politics; and, as a result, the work had been brought to a high degree of efficiency. Inspection, under civil service, in this state, meant just exactly what it said. The mine inspectors were obliged to report to the Civil-Service Commission, for each month, before the seventh day of the following month. Under the rules adopted by the commission, "A false statement in an efficiency report was sufficient ground for discharge from the service." This note was printed at the bottom of each inspection-report blank, and every mine inspector understood its significance.

When the Democrats came into power, in the change of administration in the state, they naturally wanted all the offices they could control. To assist them in their efforts to secure these, they had the advantage of an obliging attorney-general. It transpired that, under the Republican administration, the civil-service law was signed after the mining law; and the attorney-general had ruled that this fact would place the mine inspectors under the civil service. But, to offset this, a further ruling was made to the effect that "All persons who are appointed by the governor and are under bonds are not under civil-service control."

It is needless to comment on the fact that, as a result of the first examination held by the new board of examiners, 19 out of 34 candidates who took the examination passed successfully. This result was in marked contrast with a previous examination held under civil service, where only 6 out of 29 candidates passed the examination. The standard of excellence of the new board is suggested by the claim, made by a prominent member of the board in discussing one of the questions given in the examination, that "The size of a hoisting engine depends on the drum."

I do not make this statement in the spirit of retaliation, but to show that, in politics, it is difficult to secure the appointment of capable men, either to serve on the examining board or in the inspection of mines. On the other hand, many office seekers and wire-pullers obtain the appointment to these important and responsible positions, as a reward for their political activities.

At the present time, a strong effort is being made in Illinois to make the office of state mine inspector an *elective* instead of an *appointive* office. This effort emanates from the state mine workers' organization. At its convention, held in Peoria, last March, a resolution was passed recommending that all state mine inspectors should be elected by popular vote. It is understood that a bill will be introduced into the state legislature now in session, providing for such an enactment. There is, however, no doubt but that a strong fight will be required to pass such a law, as the attempt will meet with determined opposition.

Of the two evils, I would much prefer to see the mine-inspection department under the baneful influence of politics, than to see that office made elective. Under politics, a mine inspector may be an honest man; but, under the elective system, honest mine inspection is practically out of the question. In order to hold his office, the inspector must overlook many flagrant violations of the mining law, on the part of the miners, and condone many shortcomings of the operators. It needs no argument to convince one that inspection, under such conditions, would be a farce, jeopardizing both the safety of human life and the security of property.

A FORMER MINE INSPECTOR.

————, Ill.

Letter No. 29—The manner of selection of state mine inspectors appears to me to be one of the most important questions affecting the coal-mining industry, at the present time. This is eminently the case, in Illinois, where an attempt is about to be made to force a bill through the

present legislature, providing that mine inspectors shall be elected at the regular state elections instead of being appointed by the governor, as formerly, or by the Civil Service Commission.

There is, perhaps, no question demanding greater attention, in respect to needed legislation than the question of efficient mine inspection. It is unnecessary to remark that mine inspectors should be in possession of the foremost mining knowledge, both practical and theoretical. A mine inspector should be a broad-minded man, capable of handling any problem that may be presented, with a clear head and without prejudice. He must be a man of courage and fearless in the discharge of the duties pertaining to his office. His character should be beyond reproach.

In order to secure men of this type and standing, I am convinced that the first requirement is an *examination,* both practical and theoretical, to ascertain the capabilities of the candidate. It is of the utmost importance that the examining board should be composed of thoroughly capable and representative men. The board should comprise, naturally, two operators, two miners and a mining engineer who is a graduate of a college and understands fully the theory, principles and practice of coal mining. The operators on the board should each be a superintendent or manager of some coal company engaged in the mining of coal. They should each possess a theoretical and practical knowledge of the principles of coal mining. The miners on the board should be men of practical experience in the mining of coal, and should possess certificates of competency obtained by them in a previous examination. A board so constituted is capable of giving a fair and thorough examination and determining with equal justice the capabilities of candidates who present themselves for examination.

When we consider that the mine inspector must meet continually with men who are the most capable representatives of both the operators and the miners, it is easy to see that an inspector must be, himself, a capable official in order to handle the various questions that arise, logically and with sound reason and common sense. There is no question but that coal mining, in this and other states, is growing in importance every day. The coal industry is advancing by strides. More capital is being expended, larger plants are being erected and extensive mines developed. The output expected from these mines far exceeds what would have been thought of a few years ago.

In the face of these conditions, it is absurdly ridiculous to consider any proposition that bids fair to lower the efficiency of the mine-inspection service. No argument is required to convince a reasonable, unprejudiced mind that such inspection service should be completely divorced from politics. The proposition to make the office elective has nothing to recommend its adoption to one who is at all familiar with the responsibilities of the position and its requirements.

Let one consider, for a moment, and ask himself the question, How can an inspector discharge the arduous duties of his office when, by so doing, would mean to forfeit his reëlection to the office? Is it not more than can be expected of human nature, for one to take an independent stand in opposition to the forces and elements to which he must look for support in future elections? As a consequence of this condition, would not the mine inspector become simply an office seeker—a good fellow with the operators and a diplomatist with mine workers, having always uppermost in his mind the chances of his reëlection to office? Can anyone say but that this would be the natural result and outcome of making the office of mine inspector an elective office?

The man must be blind indeed who cannot see that the adoption of the elective system, in the selection of men to serve as mine inspectors, would practically eliminate the question of *fitness* or *capability.* The success of the candidate for office would depend, first, on the number of votes he could command, in respect to his nomination; and, second, on the success of his party at the polls. The question may well be asked, *Why should the lives of men working in the mines and the security of valuable property be made to depend on such uncertain and changing conditions as are assured in politics?* A careful study and familiarity with the situation make the conclusion almost inevitable that neither the *miners* nor the *operators,* as a class, should be permitted to influence or in any way control the selection of a state mine inspector; because the interests of both of the parties named will be and are seriously affected by the conscientious discharge of the duties that devolve upon the inspector.

At the annual meeting of the Mine Inspectors' Institute, U. S. A., held at Birmingham, Ala., June, 1913, the inspectors present engaged in a very interesting discussion of this subject. It was generally shown by the experiences given that the elective system, in respect to mine-inspection service, seriously impaired the efficiency of the work. It was shown that not only was much time lost through the necessity of electioneering on the part of the inspector, but that he was seriously handicapped in the matter of enforcing the mining law. It was stated that the influence of the United Mine Workers' Organization was particularly harmful, under the elective system, since any failure of the mine inspector to comply with a request coming from an official of that organization was at once heralded throughout his district and the matter taken up by the several locals in a way that promised that the said inspector would fail of reëlection, a succeeding term. It was further shown that, under such a system, the inspector is constantly used as a tool to adjust matters that are wholly outside of his province. Reference was made to the work that COAL AGE had already done to combat this law, and the hope was expressed that this work would be continued.

In closing, I want to indorse what has already been said in reference to the length of tenure of office, in the case of state mine inspectors. I want to say that the longer the inspector is in office, the more capable, efficient and valuable he becomes as a state official. Any change in the inspector means a handicap to the service in that district, as it requires time for a new inspector, no matter how capable he may be, to understand and become familiar with the working conditions of the mines in his charge. He must learn anew the attitude of the operators and miners in that district.

Again, it is plainly evident that, having acquired this knowledge of affairs and conditions, the method of treatment by a new inspector will differ materially from that of his predecessor in office; and this fact threatens an increased expense and annoyance to the operator and jeopardizes the harmonious relations existing between employer and employed, which the old inspector has been able, by

his long and intimate relation, to establish. For these and other reasons, I believe that an inspector should be appointed for good behavior and removable only for cause, to be established through regular judicial action before a proper tribunal.

MINE INSPECTOR.

————, Penn.

Drying Washed Coal

Letter No. 3—Referring to the question of John Hammond in regard to the drying of washed coal, I would suggest, as the best means available for his purpose, at the present time, the use of centrifugal coal driers, which are something new on the market and for which I have heard of claims being made that the moisture in coal can be reduced to, approximately, 3 per cent. I believe, however, that such statements have been frequently misunderstood, as I think it is more generally admitted that the best that can be expected of these machines is a reduction of the moisture to about 3 per cent. *above the ordinary moisture content of the raw coal before washing.*

I have been doing considerable experimenting with one of these machines and, under certain conditions, have succeeded in reducing the moisture to about 4.5 per cent., which is the lowest obtained to date. I believe, however, that it is too early to predict the possibilities of these machines of the various makes; and I do not believe that definite information can be given, until they have been tested under commercially operating conditions, for several months. I believe, however, that there are good possibilities in them.

In regard to the probable increased cost of drying the coal by these machines: I think it is, also, too early to predict just what the final cost will be; and would not care to be quoted in that regard at this time.

Outside of centrifugal driers, the only other methods of drying the washed coal are through the storage of the coal in suitable bins. The extent, however, to which the moisture can be reduced depends largely on the size of the bins, as compared with the plant capacity; or, in other words, the length of time the coal can be permitted to drain before being drawn from the bin. Such systems are quite common and the results of their use are undoubtedly known to this correspondent, and I assume no further discussion of that point is required.

I shall be glad to give additional information in regard to centrifugal driers at such time as the work has been carried to a point where such data will be of definite value.

G. R. DELAMATER,
Consulting Enginer.

Harrisburg, Penn.

Study Course in Coal Mining

BY J. T. BEARD

The Coal Age Pocket Book

Size of Discharge Portal—The required diameter (d) of the discharge portal of a centrifugal pump, as stated previously, depends on both the gallons (G) of water pumped and the head (h) against which the pump discharges. This is calculated by the formula

$$d = 0.56\sqrt{\frac{G}{\sqrt{h}}}; \text{ or } \sqrt{\frac{G}{\sqrt{10\,h}}}$$

It is evident, therefore, that the area of the discharge portal of the pump is always less than that of the column pipe, the diameter of which is calculated for the given discharge (G) and a velocity of 400 ft. per min., as in other types of pumps, according to the formula previously given,

$$d_c = 0.25\sqrt{G}$$

Diameter Ratio for Different Heads—Comparing the two formulas last given, it is clear that the ratio of the diameter of the column pipe to the diameter of the discharge portal of a centrifugal pump is independent of the quantity of water pumped, and varies as the fourth root of the discharge head. This diameter ratio is given by the formula

$$\frac{d_c}{d} = \frac{0.25}{0.56}\sqrt[4]{h} = \text{say } \frac{4}{9}\sqrt[4]{h}$$

In other words, the suitable diameter of column pipe for a double-suction, volute pump is found by multiplying the diameter of discharge in inches (number of pump), by four-ninths of the fourth root of the head in feet. For example, a No. 10 pump of this type, discharging under a head of 150 ft. will require a 16-in. column pipe to reduce the velocity of the flow to, approximately, 400 ft. per min., in the pipe.

Capacity of Double-Suction, Volute Pumps—Calling the number of this type of pump N, the rated capacity of the pump, for a maximum efficiency and a given head (h) in feet, is given approximately by the formula

$$G = N^2\sqrt{10\,h}$$

Limitations in Practice—Naturally, the adaptation of centrifugal pumps, like centrifugal fans, is limited to certain conditions, in respect to the quantity of water to be handled and the head. For the same pump, within certain limits determined by a falling off in efficiency, the discharge varies as the square root of the head.

For example, a small No. 2, double-suction, volute pump capable of throwing, under a 50-ft. head,

$$G = N^2\sqrt{10\,h} = 2^2\sqrt{10 \times 50} = \text{say } 90 \text{ gal. per min.}$$

is not an efficient pump to use under a head of 100 ft. or more. In other words, pumps of this class have their limits of capacity, owing to the rapid decrease of efficiency as the head is increased. The formulas given for estimating the size and capacity of these pumps relate to the maximum efficiency of the pump.

The Coal Age Pocket Book

Table Adapted to Pumping In Mines—The following table has been specially prepared to meet the conditions common to coal mining. Owing to the rapid corrosion of the pipes by the acid mine water, the usual tables giving the loss of head due to friction for the flow of water in pipes do not apply, except when the pipes are new. When using such tables it is safe to add from 20 to 25 per cent. to the values given.

The table given below is estimated for a coefficient of friction $f = 0.01$, instead of 0.0075 or 0.008, as is often done. The heads due to friction in the suction and column pipes are based on velocities of 200 ft. and 400 ft., respectively, and estimated for a 10-ft. suction and a 100-ft. column pipe or discharge head. This makes the total static head or lift 110 ft.

TABLE SHOWING SIZES OF SUCTION AND COLUMN PIPES, FRICTION VELOCITY AND TOTAL HEADS AND TOTAL PRESSURES, FOR DIFFERENT CAPACITIES

Water Pumped or Capacity (G.p.M.)	Friction Head, 10-Ft. Suction ($f = 0.01$) (Ft.)	Friction Head, 100-Ft. Discharge ($f = 0.01$) (Ft.)	Diameter of Suction Pipe $v_s = 200$ F.p.M. (In.)	Diameter of Column Pipe $v_c = 400$ F.p.M (In.)	Velocity Head in Suction Pipe (200 F.p.M.) (Ft.)	Velocity Head in Column Pipe (400 F.p.M.) (Ft.)	Static Head or Total Lift (Ft.)	Total Effective Head (Ft.)	Pressure Against Which Pump Operates L.p.s.i.
50	0.336	18.85	2.47	1.75	0.17	0.69	110.0	130.0	56.4
100	0.238	13.33	3.50	2.50	....	....	.....	124.4	54.0
200	0.168	9.43	4.95	3.54	....	....	.....	120.5	52.3
300	0.137	7.70	6.06	4.33	....	....	.....	118.7	51.5
400	0.119	6.67	7.00	5.00	....	....	.....	117.6	51.0
500	0.106	5.96	7.83	5.59	....	....	.....	116.9	50.7
600	0.097	5.44	8.57	6.12	....	....	.....	116.4	50.5
700	0.090	5.04	9.26	6.61	....	....	.....	116.0	50.3
800	0.084	4.71	9.90	7.07	....	....	.....	115.7	50.2
900	0.079	4.44	10.50	7.50	....	....	.....	115.4	50.1
1000	0.075	4.22	11.07	7.90	....	....	.....	115.1	50.0
1200	0.069	3.85	12.12	8.66	....	....	.....	114.8	49.9
1400	0.063	3.56	13.10	9.35	....	....	.....	114.5	49.8
1600	0.059	3.33	14.00	10.00	....	....	.....	114.3	49.7
1800	0.056	3.14	14.85	10.61	....	....	.....	114.1	49.6
2000	0.053	2.98	15.65	11.18	....	....	.....	113.9	49.5
2500	0.048	2.67	17.50	12.50	....	....	.....	113.6	49.3
3000	0.043	2.43	19.17	13.69	....	....	.....	113.3	49.2
4000	0.038	2.11	22.14	15.81	....	....	.....	113.0	49.1
5000	0.034	1.89	24.75	17.68	....	....	.....	112.8	49.0

The table gives the diameters of the suction and column pipes for the velocities named above and for different quantities discharged varying from 50 to 5000 gal. per min.

The friction head for other lengths of vertical suction and column pipes are easily found from the values given in the table. The length of inclined pipes must be found by dividing the vertical head by the sine of the angle of the slope or inclination. The table gives the exact diameter of pipe required instead of the nominal size.

Inquiries of General Interest

Pump Troubles

I want to ask, What would cause a duplex pump to overreach; or, in other words, what is the possible cause of this pump making a stroke of 15 in. on one side and 21 in. on the other side, when each side of the pump should have a stroke of 18 in.? The pump is of the Worthington type and, I may say, the water-end is in perfect condition. Our machinist in charge says that the steam valves are right. Except for the unequal stroke of the pistons, the pump is doing excellent work.

I also want to ask how much pressure the springs controlling the water valves of the pump should have. The pump is discharging against a pressure of 90 lb. per sq.in., through an 8-in. column pipe. The dimensions of the steam- and water-ends are as follows: Steam-end—high-pressure cylinder, 14 in. diameter; low-pressure cylinder, 20 in. diameter. Water-end—plunger, 11½ in. diameter. The length of stroke is 18 in. There are four suction valves and four discharge valves. What size of spring-brass wire should be used on these valves, assuming the diameter of the springs is 5 in.?

I would also like to know what danger there is, if any, in operating a pump in the condition I have stated.

MINE FOREMAN.

Coral, Penn.

There is nothing unusual or peculiar in the action of a duplex pump, as described by correspondent. It is well known that there is nothing to determine the exact length of the stroke of a pump, which may be a little longer or shorter than the specified normal stroke. The stroke is brought to rest by the admission of live steam in that end of the steam cylinder when the valve closes the exhaust port and opens the steam port. The movement of the two pistons of a duplex pump is not correspondingly uniform; and the length of the stroke of each piston is, therefore, independent. The relative distance through which each piston moves, in a single stroke, will depend not only on the movement of its valve, which is actuated by the opposite piston; but, likewise, on the stiffness of the moving parts and resistance of the valves on the respective sides of the pump.

We are advised, further, that it is possible that the cross-exhaust valve, in this particular pump, is not free to open between the cylinders, this being a compound, duplex pump. We would suggest that the machinist look carefully to the valves, again, on each side of the pump and reëxamine their setting, as this is most frequently the chief cause of such a difficulty.

The inquiry does not state anything in regard to the conditions of suction, in this case. It frequently happens that, on a very long or a very high suction, the springs controlling the suction valves must be extra light, in order to allow for the increased suction head.

The information desired in regard to the proper tension of the springs and size of brass wire required can be best obtained by corresponding directly with the manufacturers of this pump, who will be pleased to give such information and further advice as is necessary. In writing for such information, it is always required to give the number of the pump. While the observed irregularity in the action of this pump may be due to other causes, which can be detected only by a close and careful inspection, such as faulty pipe connections or bad packing, it is more than probable the trouble is in the valves.

Available Oxygen

Will you kindly explain how it is that when we are taught that oxygen is the mainstay of combustion, and anything burnt in pure oxygen is consumed with extreme rapidity, the effect of carbon dioxide, which contains more oxygen than carbon monoxide, is to *extinguish* flame while carbon monoxide *assists* the combustion.

We are taught that carbon dioxide contains two atoms of oxygen and one of carbon, while carbon monoxide contains only one atom of oxygen and one of carbon. It would seem that the gas containing the greater percentage of oxygen would naturally be the better supporter of combustion; but, on the contrary, in this case, the gas containing the less oxygen assists combustion, while that containing more oxygen has an opposite effect.

STUDENT.

Dubois, Penn.

In order for oxygen to support the combustion of matter, it must be available or free. The oxygen contained in both of these gases mentioned by correspondent is combined with carbon and is not available or free to support combustion.

The fact that carbon monoxide acts to assist combustion, while carbon dioxide has the opposite effect and reduces the combustion of matter, is due to the respective properties of these gases. Neither of the gases is a supporter of combustion of carbon or carbonaceous material. Carbon monoxide, however, is a *combustible* gas, while carbon dioxide is an *incombustible* gas. The former will therefore burn in an atmosphere of oxygen and produce, as a result, carbon dioxide. It is the heat of this combustion of the gas that assists the combustion of carbonaceous matter when this gas is present.

On the other hand, as stated, carbon dioxide being *incombustible* will not burn even in the presence of free oxygen. Therefore, when carbon dioxide is present in the atmosphere, it serves to dilute the oxygen present, making the percentage of available oxygen in the atmosphere less and thereby reducing the activity of the combustion. Not only this, but the incombustible gas when present absorbs the heat of the combustion taking place, which again reduces the rapidity of the combustion. It must be remembered that the activity and rapidity of combustion depend on the relative affinity of the elements of the combustibles for those of the supporter of combustion and the percentage of available oxygen present in the atmosphere.

Examination Questions

Alberta, Canada, Examination for First-Class Certificates, Held June 23-25, 1914

VENTILATION—(*Selected Questions*)

Ques.—What is meant by the term "occluded gases"? Name the occluded gases found in coal mines. What other gases are met with in coal mines and how do they originate? State briefly the characteristics of each gas.

Ans.—The occluded gases of coal mines are those naturally contained (occluded) in the pores of the coal or other strata. In many cases, these gases have escaped from the pores of the coal and rock and are held confined in pockets or other void spaces in the strata. The occluded gases of coal mines are: Methane or marsh gas (CH_4), olefiant gas or ethene (C_2H_4), carbon dioxide (CO_2), nitrogen (N), oxygen (O) and, in a few instances, ethane (C_2H_6). The other gases found in coal mines are: Carbon monoxide (CO) and hydrogen sulphide (H_2S). Neither of these two gases is found occluded in coal formations. Carbon monoxide is a product of the explosion of gunpowder and some nitroglycerin compounds, or of the slow combustion of carbon in a limited supply of air. Hydrogen sulphide is a product of the decomposition of pyrites, in the presence of moisture, the pyrites being frequently associated with coal formations.

The principal characteristics of the gases mentioned are briefly as follows: All the gases are colorless and without odor, except hydrogen sulphide, which has a strong, pungent odor resembling that of rotten eggs. Methane, carbon monoxide and hydrogen sulphide form explosive mixtures with air. Although carbon monoxide and hydrogen sulphide are generally considered the only poisonous gases, both being deadly in their effect on the human system, carbon dioxide has a distinctly toxic effect, producing headache, nausea, pains in the back and limbs and death by suffocation. Nitrogen is an inert gas, serving to dilute the oxygen of the air and other gases, but playing no other part in general chemical reactions. Oxygen is the great supporter of life and combustion. Olefiant gas, when present in firedamp mixtures, lowers the point of ignition and increases the explosive condition.

Ques.—If the total quantity of air circulating in a mine is 120,000 cu.ft. per min., with a water gage of 3.5 in., find the indicated horsepower of the fan engine, taking the combined efficiency of fan and engine as 70 per cent.

Ans.—The pressure corresponding to a water gage of 3.5 in. is $3.5 \times 5.2 = 18.2$ lb. per sq.ft. Then taking the combined efficiency of fan and engine as 70 per cent., the indicated horsepower of the fan engine is

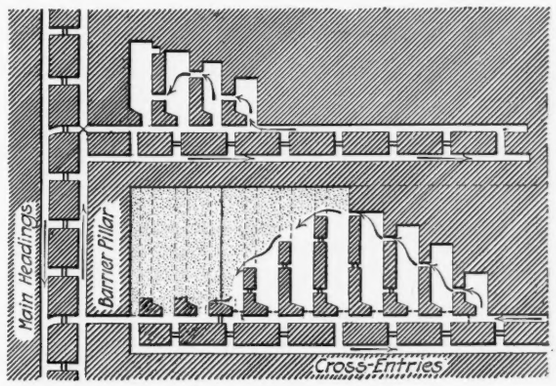
$$H = \frac{120{,}000 \times 18.2}{0.70 \times 33{,}000} = 94.5\ hp.$$

Ques.—A seam of coal lying at an inclination of 35 degrees is worked on the room-and-pillar system, the rooms being driven up the pitch. The distance between each set of levels is 400 ft. Several pillars in the lower panel have been extracted and the strata overlying the coal seam give off CH_4 freely. Rooms are still being driven to the rise of this gob and also on the inby side of it. Show by means of a sketch how you would ventilate this part of the mine.

Ans.—The question states that rooms are still being driven "on the inby side" of the section in which the pillars have been drawn. The plan is therefore the advancing system of working. Under the conditions named, it would have been better to have adopted a panel system of working, and worked each panel on the retreating plan. By that means, all of the coal, including that mined from the pillars, could have been hauled out on the intake air without difficulty.

Under the conditions named in the question, it is important to ventilate the levels by separate air splits, carrying the air in to the head of each level and returning it through the rooms in such a manner as to sweep the face of each place, as shown by the arrows in the accompanying figure.

The current, after sweeping the edge of the falls in the pillar workings, will be laden with gas and is conducted at once into the main return airway and passes out of the mine. To avoid hauling any coal on this air, a crosscut should be opened on the cross-entries at a point inby of the pillar section and a switch laid there to take the coal out on the intake air. It will be necessary to put a door on this crosscut and to backswitch the pillar coal to this door to avoid the gas.



Ques.—The ventilating fan at a mine is exhausting, but is made reversible. Explain under what emergency arising underground would the reversal of the ventilating current be of benefit.

Ans.—In the development of a large mine, it frequently happens that the main roads and airways must traverse a large section of old workings that have been abandoned long since and sealed off. In many instances heavy falls have broken the cover to the surface. Since, in the exhaust system, the mine is ventilated under a pressure below that of the atmosphere, the outside air is forced down through the breaks and the gases accumulated in the old workings are driven out into the mine. The reversing of the fan will obviate this difficulty.

Coal and Coke News

Harrisburg, Penn.

The following is a copy of the letter being sent out by the burgesses of the various municipalities in the anthracite region to the saloon keepers of these municipalities:

Owing to my position as burgess of this municipality, and the fact that the chief industry within the limits of my jurisdiction is the mining and preparation of anthracite coal, which you are aware, cannot be accomplished without considerable risk to the lives and welfare of those employed in this dangerous vocation, I have been requested to send each of you a letter, asking, if you will join in a voluntary movement not to open your respective places of business for the sale of liquor until the hour of 7 a.m. and close the same not later than 11 p.m. The chief reason for making this request is that the various coal mining companies operating in this vicinity are making an earnest effort to reduce the number of serious and fatal accidents which occur at frequent intervals in their mines.

During the year 1914 a large number of serious and fatal accidents occurred in the mines located in this borough. These accidents result in untold suffering of the victims and in addition, in many instances, are the cause of distress and want among the large number of widows and orphans created in each mining village by the untimely death of the father and wage-earner, thus depriving many families of their only visible means of support. You will no doubt agree that when an accident which causes the death of a father or son occurs, not only the family deprived of a wage-earner suffers, but it is a decided loss to our community at large.

It has come under the observation of officials in charge of our mines that many men who have been injured or killed have been frequent patrons of the saloon until a late hour at night and on their way to work in the morning. Mining accident statistics, which are compiled from year to year prove that many of these unfortunate occurrences transpire during the morning hours. Six hundred and twenty-four persons were killed and several thousand injured, in the anthracite mines during 1913. I do not intend to infer that all these accidents were caused by the use of alcohol, but the men in charge claim to have several specific cases to which they can refer whose victims were in the saloon late the night before, and again on their way to work. This is not a prohibition movement, but one of common-sense regulation.

Will you do your part to help it along by keeping your place of business closed between the hours designated?

Many Bills Are Introduced

Members of the legislative committee of the United Mine Workers of the anthracite and bituminous districts expect to urge the legislature to provide for an assistant mine inspector in every district. An assistant inspector, they contend, will double the frequency of inspections and this plan was preferred over that of asking for the creation of 10 additional inspectors.

It is the plan of the mine workers to draw up a bill making the salary of these assistant inspectors $2000, and it is said this bill will be ready for presentation to the Legislature in about two weeks. The lobby to be maintained by the mine workers will devote considerable of its time to the Compensation Act.

During the week two bills were introduced into the legislature, one in the Senate and one in the House, either of which will, if passed, do away with case beer and "family trade" in Pennsylvania. It is explained that the bills' primary object is to prevent the wholesalers, brewers, etc., from sending beer into the mining towns where there are no licensed saloons. The penalty provides for a fine of $100 and the loss of license for five years.

Mr. Garner introduced three bills during the week, one providing that all mine foremen, assistant mine foremen or firebosses, in making examinations of the mines before the men enter their working places in the morning, shall be accompanied by at least one miner. It contended that these foremen are compelled to travel many miles in dangerous and gaseous places and are the only men in the mines for hours at a time, and that many have been overcome by deadly gases or injured while thus making these examinations and have died before any workmen arrived. The bill says that but little cost would be placed on the operators to detail an experienced miner to accompany the foremen on the examinations of the mines.

The second bill provides for the employment of an assistant hoisting engineer for one hour in the morning and one hour in the evening, while men are being lowered and hoisted into the mines. Mr. Garner states that accidents have been caused by the sudden illness or injury to hoisting engineers and in one case an engineer was intoxicated while on duty and no other person was in the engine house to stop the engine and the cage was drawn to the head of the frame and six miners were killed. The bill carries a penalty of $100 for each day of violation.

The third bill of the trio, all of which pertain to anthracite mines, is for the purpose of overcoming the decision of the Dauphin County Court, which sustained the Attorney General in his decision that any one working in anthracite mines was a miner. This bill provides that before any one shall receive a certificate of qualification as a mine foreman or assistant mine foreman, he must have given satisfactory evidence to the board of examiners of at least five years' practical experience as a miner "in the actual work of cutting coal at a face."

PENNSYLVANIA

Anthracite

Mayfield—When the boiler of a mine locomotive burst, while pulling a trip of coal cars on Jan. 27, Mrs. Mary Wazerchak and daughter, aged 14 years, who were riding on the trip, and the engineer as well, were quite seriously burned. The locomotive was the property of the Moosic Mountain Coal Co., and was hauling its last strip of coal cars from Jessup to the breaker at Marshwood.

Scranton—The Delaware, Lackawanna & Western R.R. Co. is having prepared various designs of steel cages which will be submitted to a board of the Lackawanna's mine superintendents within a short time, and one of the designs will surely be adopted. Just what it will cost to install the new style carriage in all the company's mines has not been stated, but it is thought it will be in the neighborhood of $50,000. The argument that mine gases would have a corrosive effect on the steel and tend to weaken the carriage is not given much consideration. It is stated that steel carriages have been in use for five years in some mines and that the improved style has more than paid for the additional cost.

Rappahanock—Over 1000 men and boys were given employment on Jan. 25, by the Lehigh Valley Coal Co. at the new concrete and steel breaker located here, which has been erected on the site of the old Packer No. 5 breaker. Work was started on the breaker about a year ago. The building is absolutely fireproof the floors being of concrete and lighting accomplished by electricity. It is the only breaker in the Hazleton region in which cars are loaded by means of a belt. Both empty and loaded cars will be weighed on the one scale in the new breaker.

Rohrsburg—While digging a skunk out of a hole on his farm, in Columbia County, on Jan. 25, Bert Everett discovered the outcropping of a vein of coal. He started to uncover the measure and from all indications it is over 12 ft. in thickness.

Bituminous

Pittsburgh—On Thursday, Feb. 11, a representative of the Inter-State Commerce Commission will hear testimony of railroads and shippers, pro and con, as to the justice and merits of the so-called "spotting car tariff" sought to be imposed by the carriers in furtherance of previously expressed suggestions of the commission and suspended by that tribunal pending inquiry regarding it. In this connection the commission has caused it to be understood that the burden of proof of the necessity for the charge proposed, rests upon the railroads, and, also that only the testimony of shippers specifically mentioned in the suspended tariff will be heard.

Boswell—The mines of the Randolph Coal Co. are to have their capacity increased by the installation of a complete electrical equipment. With the aid of the new equipment it is expected that the daily output will be sufficient to enable the company to meet the competition of many larger mines.

Iselin—Following an attempt to dynamite the big company store building of the Buffalo, Rochester & Pittsburgh Coal Co., the mines have been shut down. Two attempts were made to dynamite the miners' hall at that place and the home of an official of the coal company before the latest outrage which damaged the big store building considerably.

Ebensburg—Three men were killed and six injured when a rope broke on a loaded trip of coal cars at Delaney, Jan. 28, permitting the cars to run down the slope into an empty train, upon which men were riding.

Mine Inspector Monteith, of the 15th Bituminous District, comprising the northern part of Cambria County and the Greenwich mines in Indiana County, believes that the 1914 production will be about 5,000,000 tons, or 1,000,000 tons less than that for 1913.

Uniontown—Orders were recently issued by the H. C. Frick Coke Co. to fire immediately 1000 coke ovens which have been idle for a year or more. These ovens are scattered throughout the entire Connellsville district, about 20 plants being affected.

Receivers were recently appointed for two more business men of Fayette County, William M. Thompson, brother of J. V. Thompson, and Jasper Augustine, a business associate of the latter. Both men owned coal lands and placed their assets far in excess of their liabilities.

Washington—C. J. Kelley and William Gregory, mine foremen at the No. 2 mine of the Meadowlands Coal Co., recently entered pleas of guilty to violating the mining laws. They had neglected to protect, as required by law, trolley wires at a parting in the mine, since this parting was to be abandoned shortly. They were each fined $40 and costs.

WEST VIRGINIA

Bluefield—It is reported that the sale of the Big Vein Pocahontas Coal Co. has been confirmed by the court. This operation was sold on Dec. 31 at auction and bought in by the bondholders for $356,000. It had been working under receivership for about four years, and it is reported made considerable money during that time.

Huntington—It is said that the Ohio Guyan Valley Coal Co. has arranged to take over the holdings of the Rocky Creek Coal Co. at Chapmansville. This firm is one of the Ohio operators that is seeking coal in the West Virginia field.

VIRGINIA

Pocahontas—The first National Bank of Pocahontas, owner of 14 bonds, of $1000 each, and Andrew C. Snyder, of Baltimore, owner of 12 bonds of the Big Vein Pocahontas Coal Co., recently filed a bill for an injunction in circuit court No. 3, against Thomas C. Boswell, Michael Sheehan, Merville H. Carter, John C. Krug, and Frederick H. Hack, constituting the bondholders' committee, the Big Vein Pocahontas Co., and the Colonial Trust Co., and Elmore D. Jeffrey. The bill alleges that the bondholders' committee undertook to disregard the rights and obligations of one of the members, and held meetings without his knowledge or consultation with him. The bill asked for an injunction to prevent the purchase of the coal lands involved.

ALABAMA

Birmingham—Twenty-eight out of the class of 33 men taking the semi-annual examination for positions of first and second class foremen and fire bosses passed. A. C. Ramcey of Littleton received the highest mark—97—in the first class.

KENTUCKY

Graham—The W. G. Duncan Coal Co. has built and equipped a "moonlight" schoolhouse in which a night school will be conducted. This is a part of the state-wide campaign to wipe out adult illiteracy in Kentucky.

Uniontown—It is reported here that the Deep Water Coal Co. which has extensive plans for taking over a large coal area in this part of the state has asked for a two months' extension of options which the promoters held on large coal holdings. It was reported recently that the deal had been closed but confirmation is lacking.

Whitesburg—J. H. Hopkins and associates of Virginia have taken a lease on the E. M. Webb coal land tract near Sergent on the Lexington & Eastern R.R. It is announced that they will begin immediately on an operation which is to have a daily output of from 800 to 1000 tons.

Harlan—A group of former Alabama operators who some time ago entered this field and leased the Harlan Home Mining Co.'s operation from A. B. and D. B. Cornett and reorganized the company as the Republic Coal Co., have recently undertaken a second development. They have taken an 800-acre lease on land owned by John H. Smith and Judge W. F. Hall and will build one mile of railroad and begin operating in the spring. This group of operators is headed by E. O. Guthrie.

OHIO

Bellaire—The Purseglove-Maher Coal Co., which recently made arrangements for opening a new mine in Logan County, W. Va., has shipped its horses to the new operation, at which a large amount of work has already been done. A new railroad track is to be constructed to the mine, and it is said that the operation will be ready for work within a few weeks.

Nelsonville—The Robbins Coal Co. which has a normal output of 600 tons daily has closed down its mines indefinitely, because of lack of business.

Rendville—The shutting down of the mines of the Sunday Creek Co. in the Hocking Valley is the cause of much suffering and destitution among the miners of that section. Recently the chairman of the board of education visited Columbus and appealed for donations of food, clothing and money to relieve the suffering. Many of the mines have been closed down entirely and others are being operated with a small force of men.

ILLINOIS

Duquoin—The mining property of the Benton District Coal Co. at Hanaford which recently went into the hands of a receiver, has been sold for $60,000. This deal was completed by Herman Rea of Christopher, receiver of the property.

Edwardsville—The hoisting apparatus at the mine of the East Side Coal Co. broke recently when the cage, with four miners upon it, was 130 ft. from the bottom. After dropping a few feet, the safety clutches stopped the fall. This is the second case in about three weeks of the same kind of an accident happening to mines in this county.

Benton—Engineers for the Illinois Central R.R. are completing a survey of the proposed new line from Hanaford, east of Benton, to West Frankfort, to the Franklin County coal fields. The proposed branch will be 7 miles long and, it is understood, will be the beginning of a new line of the Illinois Central extending from Hanaford southeast through the Franklin County coal field, and through the eastern section of Williamson County, down into the Saline field in and around the Harrisburg district. It is understood that the extension into the Saline County field will not be completed at this time, but it will only be a matter of a few years until the eastern field is open, and the Illinois Central is preparing to get its track in through this virgin coal field.

ARKANSAS

Bates—The Bates Coal Mines have been leased for five years by local coal miners who will renew active operations. These mines have, in the past, been operated at a loss but the miners believe they can make a profit.

Fort Smith—The deal for the purchase of the Bache-Denman Coal Co.'s Hartford Valley holdings by the United Mine Workers of America, has not been consummated. It is believed however that this deal will be closed within a short time.

FOREIGN NEWS

St. Johns, Newfoundland—An expedition to discover coal in the Hudson Bay district which may be utilized in connection with the proposed opening of the Hudson Bay Ry. is understood to be the mission of the schooner "Laddie" equipped here. This expedition is being financed by the Canadian railway operators, Mackenzie & Mann. One of the most essential factors to the successful carrying out of the Hudson Bay project will be the securing of an adequate coal supply for both steamers and trains. When the road reaches the seaboard and terminals are constructed at Fort Nelson, provision will be made for the storage of large quantities of coal both from western Canada and Cape Breton but if a supply could be secured at any point comparatively accessible for ships plying on the Hudson Bay route it would have an immense advantage.

PERSONALS

W. C. Franz has been made president of the Lake Superior Coal Co. and also the Canton Coal Co. a subsidiary.

B. F. Nigh, secretary of the Michigan-Ohio-Indiana Coal Association is busy getting up the annual year book of the organization which will be issued about the middle of April.

Kingdon Gould of New York, president of the Consolidated Coal Co. of St. Louis, and the Western Coal & Mining Co., has returned from an extended trip of examination at the various coal properties of this company in the Middle Western States.

Earl F. Scott, with offices at 702 Candler Bldg., Atlanta, Ga., has been appointed representative for the State of Georgia by the Terry Steam Turbine Co., of Hartford, Conn. H. A. Rapelye, in charge of the Pittsburgh office, is now located at 1624 Oliver Building.

George A. Harper, who was connected with the Buffalo office of Coxe Bros. & Co. when it went out of the western business and since mainly in the employ of the Lehigh Valley Coal Sales office, has been made representative of the latter company in western Michigan, with office in Grand Rapids.

P. A. Coen, general sales manager of the Sunday Creek Co. has announced the appointment of M. J. Gallagher as city sales agent in the place of E. A. Cole & Co., which formerly acted in that capacity. Mr. Gallagher has been a traveling salesman for the company for a number of years.

G. L. Douglas, assistant general sales agent, in charge of the St. Louis office for the Consolidated Coal Co. of St. Louis and the Western Coal & Mining Co., with mines scattered throughout Illinois, Missouri, Arkansas, and Kansas, has resigned to take a similar position with the Devoy & Kuhn Coal & Coke Co., St. Louis.

Arthur C. Vicary, formerly of Lorain, Ohio, has recently assumed the duties of sales manager of the steam shovel department of the Ball Engine Co., of Erie, Penn. Mr. Vicary has been engaged in the design and sale of steam shovels for years, and is widely known to steam shovel users, particularly in the eastern section of this country.

W. D. Monsarrat, formerly head of the operating department of the Sunday Creek Co. has established an engineering office in the Hardman Building at Columbus, Ohio. Mr. Monsarrat will devote his time to outside construction work such as shaft sinking, slope driving, etc., in which he has had considerable experience. He is prepared to submit bids on such work either in the United States or Canada.

E. S. White, for the past few years Southwestern representative for the Hart-Williams Coal Co. of Chicago, has been appointed general freight and passenger agent, to succeed W. H. Ogborn, of the Illinois Southern Ry. Co., with headquarters in St. Louis. Previous to his connection with the Hart-Williams Coal Co., Mr. White was assistant to one of the officials of the Missouri Pacific-Iron Mountain System.

R. E. Eggebrecht, for the past three years sales manager of the Devoy & Kuhn Coal & Coke Co. in St. Louis, will shortly assume a similar position with the Southern Coal, Coke & Mining Co. of St. Louis. Previous to his connection with Devoy & Kuhn Coal & Coke Co., Mr. Eggebrecht was connected with the Standard Collieries Co., with mines at Marion and Johnston City, Illinois, as vice-president. Previous to that he was A. G. F. A. of the Missouri Pacific-Iron Mountain System, in charge of coal traffic.

J. W. Hardy, for many years connected with various western railroads, and especially the Frisco, as a locomotive fuel expert, and for the past two years fuel engineer for the Southern Coal, Coke & Mining Co. of St. Louis, will sever his connections with that company shortly, to take the southern sales office for the West Kentucky Coal Co. at New Orleans. This office is created for the purpose of taking care of Southern trade of the West Kentucky properties, and the growing river business, and to expedite the handling of this company's product in an export way, on account of the opening of the Panama Canal. He will be succeeded as fuel engineer for the St. Louis company by J. E. Richmond, for some time past connected with this company.

OBITUARY

Col. S. M. Dalzell, general manager of the Spring Valley Coal Co., with mines at Spring Valley, Seatonville and Dalzell, Ill., died on Wednesday morning, Jan. 25, at his residence, 430 Grand Boulevard, Chicago. He had been suffering from physical infirmities for a long time, and his death although regretted by his many friends was not unexpected. Mr. Dalzell was long and favorably known in the coal trade of Illinois, and from Dec. 23, 1897, to Dec. 21, 1900, was president of the Illinois Coal Operators' Association, the duties of which office he performed with signal ability and success. He was born at Hartstown, Penn., Dec. 3, 1850, and up to recent years had always been one of the important factors in handling labor questions from the operators' standpoint.

RECENT COAL AND COKE PATENTS

Coal Recording Device. A. W. Dodge, Two Harbors, Minn. 1,121,234. Dec. 15, 1914. Filed Apr. 21, 1913. Serial No. 762,589.

Smoke Eliminator. C. Cable, Elkhart, Ind. 1,120,129. Dec. 8, 1914. Filed Mar. 24, 1914. Serial No. 826,969.

Boiler. L. D. Lovekin, Philadelphia, Penn.. 1,119,025. Dec. 1, 1914. Filed June 25, 1913. Serial No. 775,662.

Smoke Consumer. E. C. Heimlich, Detroit, Mich. 1,120,484. Dec. 8, 1914. Filed Apr. 1, 1914. Serial No. 828,665.

Furnace Structure. H. L. Meyer, St. Paul, Minn. 1,121,569. Dec. 15, 1914. Filed Feb. 21, 1913. Serial No. 749,797.

Gas Producer. P. G. Schmidt, Olympia, Wash. 1,116,131, Nov. 3, 1914. Filed Mar. 26, 1913. Serial No. 757,020.

Coal Breaker. M. H. McTurk, Philadelphia, Penn. 1,121,931. Dec. 22, 1914. Filed May 31, 1912. Serial No. 700,688.

Coal Pocket. G. D. Curtis, New York, N. Y. 1,121,328. Dec. 15, 1914. Filed Jan. 16, 1909. Serial No. 472,723.

Mine Safety Lamp. F. Farber, Dortmund, Germany. 1,116,-048, Nov. 3, 1914. Filed Dec. 2, 1913. Serial No. 804,274.

Coal Cutting Machine. M. Mysliwicz, Wehrum, Penn. 1,116,-907, Nov. 10, 1914. Filed Mar. 6, 1913. Serial No. 752,350.

Smoke Recorder. H. C. Alger, Chicago Heights, Ill. 1,122,-229. Dec. 22, 1914. Filed Apr. 6, 1914. Serial No. 829,958.

Method of Mining Coal. E. C. Morgan, Columbus, Ohio. 1,116,355, Nov. 3, 1914. Filed Aug. 4, 1905. Serial No. 272,637.

Dumping Grate for Furnaces. E. Gibson, Jersey City, N. J. 1,116,409, Nov. 10, 1914. Filed Jan. 21, 1914. Serial No. 813,391.

Coal Picking Apparatus. F. H. Emery, Scranton, Penn. 1,119,586. Dec. 1, 1914. Filed Apr. 7, 1914. Serial No. 830,152.

Coal Washing Machine. W. W. Cooper, Fortyfort, Penn. 1,121,715. Dec. 22, 1914. Filed Sept. 8, 1914. Serial No. 860,655.

Chain Grate—P. L. Crowe and A. Frankenheim, New York, N. Y. 1,115,904, Nov. 3, 1914. Filed Mar. 9, 1914. Serial No. 823,388.

Coke Oven Door. J. A. McCreary, Connellsville, Penn. 1,121,385. Dec. 15, 1914. Filed Dec. 12, 1913. Serial No. 806,308.

Boiler Grate. D. K. Briggs and T. N. Smith, Portsmouth, Va. 1,121,791. Dec. 22, 1914. Filed May 23, 1913. Serial No. 769,529.

Furnace. R. F. Almirall and C. G. Armstrong, New York, N. Y. 1,120,993. Dec. 15, 1914. Filed June 4, 1910. Serial No. 564,952.

Sectional Shaking and Dumping Grate. C. T. Coe, Albany, N. Y. 1,121,001. Dec. 15, 1914. Filed Jan. 30, 1909. Serial No. 475,091.

Locomotive Fire Box. J. Black and J. Frama, Glasgow, Scotland. 1,119,490. Dec. 1, 1914. Filed Mar. 7, 1914. Serial No. 823,190.

Means to Prevent Gas Explosions in Coal Mines. H. Hall, Wylam, Ala. 1,119,427. Dec. 1, 1914. Filed Feb. 2, 1914. Serial No. 816,121.

Mining Machine. C. E. Davis, assignor to Goodman Mfg. Co., Chicago, Ill. 1,121,002. Dec. 15, 1914. Filed Oct. 6, 1910. Serial No. 585,550.

Charging Device for Gas Producers. J. A. Herrick, Newark, N. J. 1,119,280. Dec. 1, 1914. Filed Apr. 15, 1913. Serial No. 761,179.

Securing Device for Miner's Drills. J. W. Shallenberger, Canal Fulton, Ohio. 1,115,594, Nov. 3, 1914. Filed Sept. 26, 1913. Serial No. 791,919.

Process of Producing Gas from Bituminous Fuel. O. C. Berry, Glendale, Ohio. 1,117,217, Nov. 3, 1914. Filed May 6, 1908. Serial No. 431,177.

Apparatus for Treating Smoke and Fumes. J. Mercer, New Brighton, England. 1,121,746. Dec. 22, 1914. Filed May 20, 1912. Serial No. 698,474.

Clinker Grinder and Discharger for Furnaces. O. C. Woolson, New York, N. Y. 1,121,888. Dec. 22, 1914. Filed Jan. 30, 1914. Serial No. 815,351.

Mining Machine. F. L. Sessions, assignor to Jeffrey Mfg. Co., Columbus, Ohio. 1,122,034. Dec. 22, 1914. Filed Jan. 7, 1903. Serial No. 138,158.

Apparatus for Quenching Coke. H. Koppers, assignor to H. Koppers Co., Chicago, Ill. 1,121,376. Dec. 15, 1914. Filed Feb. 1, 1913. Serial No. 746,098.

Automatic Stoker. D. T. Williams, assignor to Standard Stoker Co., Wilmington, Del. 1,118,985. Dec. 1, 1914. Filed Apr. 18, 1914. Serial No. 832,730.

Locomotive Boiler Furnace. C. B. Moore, assignor to American Arch Co., New York, N. Y. 1,115,955, Nov. 3, 1914. Filed Dec. 18, 1911. Serial No. 666,353.

Grate. A. B. Coates, assignor to Economy Forced Draft Slack Burner Co., Ellsworth, Kan. 1,119,808. Dec. 8, 1914. Filed June 17, 1913. Serial No. 774,226.

Stoker. H. B. Holt, assignor to Rosedale Foundry and Machine Co., Pittsburgh, Penn. 1,122,203. Dec. 22, 1914. Filed Dec. 8, 1913. Serial No. 805,318.

Tubular Recuperator for Retort Coke Ovens. C. H. Hughes, assignor to Semet-Solvay Co., Solvay, N. Y. 1,120,147. Dec. 8, 1914. Filed Jan. 7, 1910. Serial No. 536,807.

Steam Boiler Construction. J. W. MacDonald and D. W. Robb, assignors to International Engineering Works, Montreal, Can. 1,120,071. Dec. 8, 1914. Filed Dec. 21, 1913. Serial No. 804,221.

TRADE CATALOGS

Waterbury Co., 80 South St., New York. Catalog. "Fiberclad Wire Rope." Illustrated, 24 pp., 3½x6 in.

Pelton Water Wheel Co., 90 West St., New York. Bulletin No. 8. "Water wheels." Illustrated, 64 pp., 6x9 in.

CONSTRUCTION NEWS

Kirksville, Mo.—The Kirksville Commercial Club has a proposition well under way to extend the Big Creek R.R. to coal and clay deposits near here, and plans are made to open up these deposits in the spring.

Chicago, Ill.—It has been announced that the large tract of land which the Susquehanna Coal Co. purchased some time ago on the Calumet River at 114th St., will be improved with docks and coal handling equipment at a cost of approximately $300,000. A 1600-ft. wharf will be built while the yards will have a daily capacity of 8000 tons.

Birmingham, Ala.—Tentative plans have been agreed upon to extend a railroad from Birmingham to the Warrior River so that transportation may be secured. There will also be developments near the river, of considerable importance. All appearances seem to indicate that there will be improvements in the Warrior field of considerable magnitude within a short time.

Columbus, Ohio—At the annual stockholders meeting of the John M. Taylor Coal Co. of Columbus the announcement was made that the Taylor-Williams Coal Co., the retail department, will soon start the erection of a modern plant on Cleveland avenue, opposite the U. S. Barracks. This is made necessary by the rapid increase in the business. The plans provide for storage bins, yards, barns and an elevated track.

NEW INCORPORATIONS

Temple, Texas—The Bastrop Lignite Coal Co. has been incorporated with a capital of $75,000 to develop coal properties.

Cleveland, Ohio—Papers have been filed with the secretary of state reducing the capital of the Goshen Coal Co. from $1,000,000 to $5000.

Wellston, Ohio—The Blue Jay Coal Co. has filed amended articles of incorporation increasing its capitalization from $10,000 to $15,000, to finance more extended operations.

Oklahoma City, Okla.—The Ross-Caldwell Coal Mining Co. has been organized at Lehigh with a capital of $6000. The incorporators are A. K. Ross, Ray Caldwell, and Tom Mitchman, all of Lehigh.

Roanoke, Va.—The Eastern Kentucky Block Coal & Fuel Co. has been incorporated with a minimum capital of $10,000 and a maximum of $80,000, to engage in coal mining. The officers are W. O. Brothers, president, H. V. Brothers, secretary, both of Honaker, Va.

Crumpler, W. Va.—The United Pocahontas Coal Co. which is to have its chief works in the North Fork district of McDowell County, has been organized with a capitalization of $500,000. The incorporators are A. B. Rice, Hall Kilpatrick, J. L. Ashworth, A. A. Bosh, and C. B. Hoyt.

Quebec, Canada—The British Columbia Skeena Coal Co., Ltd., has been incorporated, capitalized at $1,000,000, with head office in Quebec by Senator P. A. Choquette, Hon. N. Garneau, W. G. Scott and J. T. Ross, to conduct general mining operations and take over the assets of the British Columbia Anthracite Syndicate.

Chattanooga, Tenn.—The Craney Creek Coal Co., owning land in Kentucky and chartered in that state, has applied for a Tennessee charter, listing its capital at $100,000. The company is allied with the Continental Coal Co., a local concern, and its incorporators are C. C. Moore, J. D. Carlin, O. P. Darwin, John E. Patton, W. E. Wilkerson.

Charleston, W. Va.—The Ivy Branch Coal Co., of Charleston, has been granted incorporation papers. The company will have its chief works in the Washington district of Lincoln County, and is capitalized at $50,000. The incorporators are A. E. Moore, John W. Moore, Angus MacDonald, Leo F. Moore, Hubert S. Moore, all of Charleston.

INDUSTRIAL NEWS

Louisville, Ky.—Announcement is made that the Kentucky, Land, Lumber & Mineral Co. is to dissolve, and claims against the firm, as well as debts owing it, are called for.

Birmingham, Ala.—Announcement has been received here that under the new ruling by the terminal companies, cargo and bunker coal will be held free for 10 days at New Orleans. This is interesting to coal men here who sell large quantities of bunker coal at New Orleans.

Cleveland, Ohio—Federal Judge Clark recently appointed receivers for the East Grafton Coal & Coke Co. and the Triona Coal & Coke Co., West Virginia corporations with offices in Cleveland. Lack of capital is blamed for the financial embarrassment of these firms.

Olcott, W. Va.—The Black Band Fuel Co. has purchased the property formerly owned by the Olcott Coal & Iron Co. operating mines at Olcott, W. Va. All matters pertaining to the Olcott property should hereafter be addressed to the Black Band Fuel Co., 1 Broadway, New York.

New York, N. Y.—The withdrawal of steamers used in the coal trade between Chesapeake Bay ports and New York for use in the trans Atlantic trade has created a demand for sail tonnage, and incidentally brought about increases in the freight rate amounting to about 25 per cent. The average time taken by sailing vessels from Norfolk to Boston is about three weeks so that it will require six schooners of 3000 tons capacity each to make up for the loss of one 6000-ton steam collier.

South Bethlehem, Penn.—An event in industrial affairs of this vicinity was the charging on Jan. 26, of 106 newly built coke ovens at the Lehigh coke plant it being the first battery of four comprising 424 ovens which are being built. Already half of the 424 ovens have been erected, but only 106 have been fired. These new coke ovens are taking the place of the old four-battery systems which were built by the Didler-March Co., a German concern and which proved a distinct failure.

Washington, D. C.—The Grand Rapids, Michigan, Association of Commerce recently complained to the Interstate Commerce Commission about the unfair rates of the Ann Arbor and other railroads on soft coal from mines in Pennsylvania, West Virginia and Ohio, to Grand Rapids, alleging that rates to Detroit and Toledo were proportionately lower than the shorter haul warranted, and asked that new rates be established from the coal fields to Michigan points as those used at present are prejudicial.

Washington, D. C.—By a recently announced decision the Interstate Commerce Commission notified the Illinois Central and other railroads that their proposed increased rates on coke in carload lots from St. Louis, Chicago, Milwaukee, and other points to destinations in Minnesota other than Duluth, in Wisconsin, Iowa, and South Dakota, are justified. The proposed increased rates on the same commodity from the same points of origin to Duluth, Minnesota, however, were held to be unreasonable to the extent that they exceed $2.15 per ton. The present rate to Duluth is $2, and the proposed rate is $2.25. The changes take effect on Feb. 28.

Cincinnati, Ohio—Petitions have been filed in the United States district court by receivers Harmon and Smith, of the Cincinnati, Hamilton & Dayton R.R., asking for the appointment of receivers to operate the Cincinnati, Indianapolis & Western Ry. Co. The petitions were filed in foreclosure proceedings instituted by bondholders represented by the Central Trust Co. and the Equitable Trust Co. of New York, against the company mentioned. The receivers of the C. H. & D. have been operating the other road, which is a connection of the former, under an agreement between the two companies, and report that its operation has been unprofitable, resulting in a deficit, and that it is now necessary to spend $140,000 for repairs to a bridge over the Wabash, and $400,000 at Indianapolis.

Coal Trade Reviews

General Review

Severe weather relieves the pressure on anthracite and working schedules are increased. Uncertainties developing in bituminous. Spectacular advance in ocean freights causing general uneasiness. The trend of conditions on new contracts generally satisfactory.

The inclement weather of this week was a potent stimulus to the anthracite market, which was beginning to show distinct indications of a break. The domestic grades are all in easy supply, the demand centering entirely on the steam sizes, the high grade of buckwheats being the leaders. Mining operations have been increased somewhat this week, and a continuance of the severe weather will result in the anthracite trade rounding out the coal year in much better form than has recently been anticipated.

Though bituminous apparently continues as heavy as ever, there are uncertainties developing which may cause a readjustment in the situation. The storms and heavy weather have not only stimulated consumption, but have delayed the movement, and consumers are showing slightly more interest in the market.

The spectacular advance in Coastwise freights has ceased for the time being, though there has been no relapse back to normal levels, and all the indications point to a still further increase; this is one of the most interesting phases of the general situation at the present time, since it means that the market for the Hampton Roads coal may soon be restricted to relatively narrow limits, causing a radical readjustment in the customary channels of trade. The accumulations at the Tidewater piers continue relatively large, and substantial cuts are doubtless being made where coal is on demurrage.

Preliminary negotiations on new contracts are being reported in the Pittsburgh district, and it is generally believed among well informed observers that prices will be on the same basis as last year. On current business the situation is slightly stronger; the manufacturing demand has toned up appreciably, particularly at the steel mills and the railroads are using a larger tonnage. Complications are rising on Canadian business over the question of exchange.

The heavy snows and low temperatures through Ohio have forced the buyers into the market again, though many of them expected to be able to hold out over the balance of the season. Orders are not large as a rule, but there is a decidedly healthy tone, and prices are relatively firm with the possible exception of the steam grades. A judicious curtailment of production, however, will be necessary to put the market on a firm basis.

The recent sluggishness in the Middle Western market has given way slightly under the influence of the exceedingly cold weather, though the large accumulations have not yet been much affected, and the mines are still working under curtailed schedules. The high grade fuels are relatively firm, but there is a general weakness in other directions which it is doubtful if even a long stretch of severe weather would materially affect.

ATLANTIC SEABOARD

BOSTON

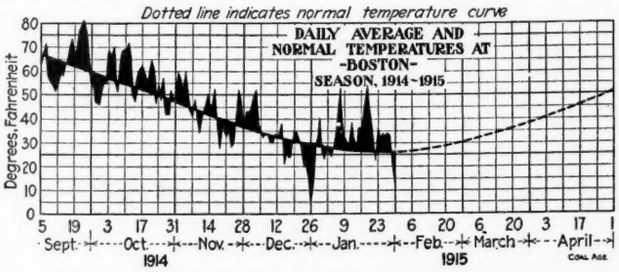
Further advance in water freights discounted; prices being made only by agencies that control transportation. Georges Creek and Pennsylvania grades show firmness for season delivery. Anthracite trade not improved.

Bituminous—There is less alarm on the part of shippers than a week ago. The interests that own their own transportation are actively in pursuit of business and are understood to offer contracts at 12@15c. up from last year either alongside or on cars. The other shippers appear to be marking time until water freights have settled into something like a reasonable season basis. High ocean freights still prevail, but it develops that there is a certain amount of steam tonnage that will not be available for over-sea business.

At Hampton Roads there are still ample supplies of Pocahontas and New River, with a very quiet demand; f.o.b. prices show practically no change. The slow movement of barges and sailing vessels has affected the volume of shipments Coastwise, and inquiry for export is only spasmodic and transient. Pocahontas and New River shippers for the most part are rather discouraged.

The contract basis, on cars Mystic Wharf, Boston, for inland delivery, is understood to be $3.90. This is 12c. up from the price at which similar contracts were closed last year and will very likely bring all-rail coals into closer competition. Spot prices on cars are firmer in consequence of the higher water rates, but there is no special activity.

The Georges Creek shippers are apparently very conservative about making delivered prices. They have done so only in a few cases, and so far have not made a rate of less than 90c. from Baltimore and Boston. Anthracite-carrying barges are still being freely chartered to enable the Georges Creek people to catch up with their orders. Prices on this grade are very firm.



Pennsylvania operators are more hopeful than for several months. This attitude is reflected in the prices named for future delivery. There is some prospect of better demand for the more favorably regarded grades and sales agents are carefully going over the ground. Meanwhile, spot prices continue on about the same level.

Water Freights seem to be marking time at $1, Hampton Roads to Boston, 2500 tons upward. The higher rates seem to have drawn out a number of bottoms that were not in evidence a week ago, and some of the brokers are busy trying to get orders; $1 to Boston has also been named as a season rate on certain types of steamers as well as schooners, but it is not believed that any tonnage has actually been closed at that rate. The Reading barge rate on bituminous from Philadelphia was advanced from 75 to 80c. to Boston points, effective Feb. 1.

Anthracite is expected to profit from the colder weather of the past week. Among the shippers all sizes are in plentiful supply.

Prices on bituminous at wholesale are about as follows:

	Clearfields	Cambrias Somersets	Georges Creek	Pocahontas New River
Mines*.....	$0.90@1.50	$1.15@1.65	$1.67@1.77	
Philadelphia*....	2.15@2.75	2.40@2.90	2.92@3.02	
New York*.....	2.45@3.05	2.70@3.20	3.22@3.32	
Baltimore*.....	.....	.....	2.85@2.95	
Hampton Roads*.	.....	.....	.....	$2.65@2.75
Boston†.....	.....	.....	.....	3.83@3.95
Providence†.....	.....	.....	.....	3.73@3.78

* F.o.b. †On cars.

NEW YORK

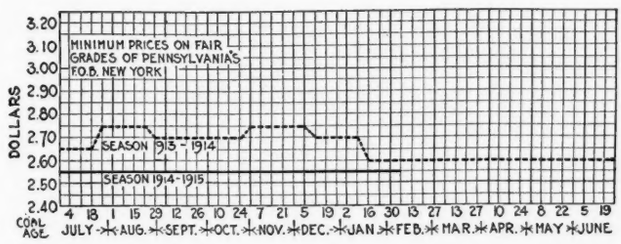
Bituminous continues quiet, with no definite indications for any improvement in sight. Interest centering on new contracts. Anthracite operations somewhat better and colder weather stimulates the movement.

Bituminous—Cold, stormy weather, accompanied by heavy fogs has interrupted the movement to some extent and caused a spasmodic demand in certain quarters, but the general situation continues monotonously the same. The operators are still holding coal rather close at the mines, but in spite of this, an occasional lot comes down on consignment and not infrequently results in a forced sale on demurrage. The bunkering trade livened up somewhat during the past week. Mine operations seem to be on about the same basis as for the past several weeks. The outlook for the current month is regarded as moderately favorable.

Negotiations have hardly yet started on contracts, although some few of the less important ones have been signed up.

Prices on these range at the same levels as last year, and it is generally felt in well informed quarters that these will be the ruling figures on new contracts, particularly as regards the higher grade standard fuels. In a comparatively short time contracting will be actively under way; the cold weather, together with the near approach of the customary contracting period, is beginning to stimulate interest among buyers and inject a little life into the situation as it is.

Prices continue unchanged. One small sale of good grade of Pennsylvania coal was noted during the week at our top quotations, $2.80, and we continue previous quotations on the same basis, as follows: West Virginia steam, $2.35@2.55; fair grades, Pennsylvania, $2.55@2.65; good grades of Pennsylvania, $2.70@2.80; best Miller Pennsylvania, $3.10@3.15; Georges Creek, $3.15@3.25.


MINIMUM PRICES ON FAIR GRADES OF PENNSYLVANIAS F.O.B. NEW YORK
DOLLARS
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
SEASON 1913-1914
SEASON 1914-1915
4 18 1 15 29 12 26 10 24 7 21 5 19 2 16 30 13 27 13 27 10 24 8 22 5 19
COAL AGE
JULY AUG. SEPT. OCT. NOV. DEC. JAN FEB. MAR. APR. MAY JUNE

Anthracite—Conservative hard-coal dealers are not missing any of the opportunities presented by the recent cold snaps to unload their coal, although occasionally one is found who is keeping a substantial surplus in hopes of a more active market later. That the situation is somewhat better, however, is indicated by the increased working schedule at the mines, which was notably larger this week. As a general thing the business may be regarded as good with companies having the more favored grades of coal, which are moving off briskly. In some instances it is noted that the large companies are even picking up some of their stocks.

Of the prepared sizes, nut is in the most active demand, although the situation is generally easy on all grades. The heavy call for stove coal of some time ago has completely disappeared. The good grades of buckwheat are in active demand in all directions and are the strongest feature of the market, with the other steam sizes continuing fairly active.

Far-sighted observers are already beginning to contemplate the possibilities of a long suspension next April, and preparations for such a contingency are receiving consideration. Should business conditions continue as bad as at present, it is obvious that the producers will make a determined stand against the customary advance demanded by the unions, which will result in a bitter, and very probably a long-drawn-out struggle.

The market is quotable as follows:

	Upper Ports		Lower Ports	
	Circular	Individual	Circular	Individual
Broken	$5.10	$4.60@5.10	$5.05	$4.55@5.05
Egg	5.35	4.85@5.35	5.30	4.80@5.30
Stove	5.35	5.05@5.35	5.30	5.00@5.30
Chestnut	5.60	5.30@5.60	5.55	5.25@5.55
Pea	3.55	3.40@3.55	3.50	3.35@3.50
Buckwheat	2.80	2.60@2.80	2.50@2.75	2.35@2.75
Rice	2.30	2.20@2.30	2.00@2.25	1.75@2.25
Barley	1.80	1.70@1.80	1.75	1.55@1.75

BUFFALO

Bituminous continues as discouraging as ever. Railroad buying light. Recession in prices on contracts. Anthracite business fair but congestions are now occasionally noted.

Bituminous—Trade is very dull; it promises now and then to improve and shippers will be encouraged by a good day or two and then it settles back apparently on the bottom again. But it is still noted that shippers continue hopeful. The mines are experiencing great difficulty in finding an outlet for the coal that should be mined, if only to keep the men from going hungry. It is difficult to find business enough to keep the mines running half time and operators are pushing the jobbers hard to sell coal. Consignment coal is a particularly bad feature of the situation and consumers are beginning to rely on this to meet their current requirements.

The Canadian trade is especially heavy on account of the dispute over the discount demanded by the banks on Canadian paper, as buyers and sellers make every effort to avoid this extra cost. It was said at the outset that this discount was not likely to last, but it has not disappeared yet and it may continue indefinitely, especially if the slow pay in Canada has anything to do with imposing it.

Railroads are not buying any more coal than formerly and this is having a decidedly depressing effect on the situation. The contract situation is not encouraging; consumers are showing little interest as they expect to get figures 10c. or so lower than last year while operators and jobbers are more than pleased when they can close at old prices. At the same time there is scarcely anyone connected with the trade who does not believe that coal will go up before fall.

There is no change in the price of bituminous. Some shippers have urged a reduction in the accepted circular but others stoutly oppose it, saying that they are getting these prices. Figures therefore remain at $2.80 for best Pittsburgh lump, $2.70 for three-quarter, $2.55 for mine-run and $2.15 for slack. Allegheny Valley coal sells for about 25c. less than Pittsburgh.

Anthracite—The very cold weather of late has improved the demand, though it is not yet satisfactory to the shipper who expects to sell as much coal as usual. There are some efforts to urge sales on the part of certain companies by advertising in local papers. Reports from Western sales centers are encouraging and it does not appear that coal is accumulating here, though shippers of independent anthracite say that at certain Eastern junction points there is more congestion than is good for the trade. The local Buffalo market is rather quiet, though weather conditions are of the best.

There is a better demand for chestnut than any other sizes, stove being decidedly quiet, with egg doing better than it was in the fall. The small sizes are finding bituminous competition sharp enough to hurt them materially.

The loading of anthracite into Lake vessels for winter storage continues slowly. There is now more than 100,000 tons afloat.

TORONTO, CAN.

Bituminous dull, but anthracite is showing some activity.

There has been a good, steady demand for anthracite for domestic purposes, weather conditions being favorable for a brisk trade. While the market for bituminous lump is rather quiet, screenings are much in requisition, with short supplies on hand and little coming forward.

Quotations are as follows, with an upward tendency for screenings: Retail, anthracite, egg, stove and nut, $8; grate, $7.75; pea, $6.75; bituminous steam, $5.25; screenings, $4.35; domestic lump, $6; cannel, $7.50. Wholesale, f.o.b. cars, three-quarter lump, $3.78; screenings, $2.79.

PHILADELPHIA

No improvement in anthracite. Discouraging features still continue. Bituminous shows little or no change.

While conditions were fair for the consumption of the fuel during the past week there is apparently no great need for coal and the same lassitude of the past six weeks still prevails. There is practically no size in any great demand, with the possible exception of buckwheat, which, under restricted mining, is short of the market requirements. Continuous soliciting is required to move even the curtailed output now in effect and it is understood that surplus coal is available, both at Tidewater and along the line. Dealers are well fixed in the matter of supplies, and from the present outlook, the trade is likely to continue sluggish for the balance of the winter season.

While reports of concessions are heard, ranging from 10 to 40c. per ton, prices on the whole are being maintained at circular. Prices at Tidewater rule about as follows:

	Circular	Individuals
Broken	$4.75	$4.50
Egg	5.00	4.75@4.85
Stove	5.00	4.90@5.00
Chestnut	5.25	5.00

Bituminous—There is no change in the soft-coal situation. Spot demand is light, and prices range about the same as last week. It is understood that contract requirements have been slightly increased, but in the main, nothing important has developed in this branch of the trade.

BALTIMORE

Poor showing in December export trade, but movement is improving. Dull market conditions for both hard and soft coals. An excellent bunker business the only local redeeming feature.

Export figures show that December was the worst month in the foreign movement during 1914. A total of but 50,712 tons was recorded. A considerable improvement is indicated by the number of vessels loaded for January, however, with good prospects for current month. The January total will probably run in excess of 70,000 tons.

The market is dull in both the hard- and soft-coal trades. From West Virginia comes the statement through local headquarters that gas coal and slack are both in poor demand. Steam coals from West Virginia and Pennsylvania were also in slow call. There is very little market for low grade coals and prices are generally low.

The past two weeks have seen little change in quotations to the trade at the mines. While there is considerable variation under press of individual necessity, quotations are about as follows:

West Virginia—Kittanning, $1.20; Freeport, 80@85c.; Fairmont, gas three-quarter, 85c.; run-of-mine, 80c.; slack; 60@65 cents.

Pennsylvania—South Fork best, $1.40; Cambria County, $1.25 with ordinary grades 95 cents; Somerset best, $1.25, fair grades $1.10@1.15.

Maryland—Ordinary steam coals, 80 to 85c.; Georges Creek regular production, $1.60 with select grades, $1.70 and some special lump grades at $1.90.

HAMPTON ROADS

Tidewater situation showing some little improvement. Prices about circular. Dumpings for month of January more than December.

Dumpings over Tidewater piers were hardly normal last week but still in excess of the previous week. There have been several export cargoes for Havana, Santiago, Cristobal, Pernambuco, and Italian ports. The coastwise movement has as usual been heaviest to Boston, Providence and Portland with other cargoes to the smaller New England ports. The placing of several of the large coastwise steamers in the foreign trade has caused a better demand for schooners and barges; a number of the former which have been tied up are again in the trade. As noted some weeks ago schooners are replacing steamers on some of the South American shipments, another of these vessels having been loaded here during the week for Pernambuco, Brazil.

Whether general conditions will be so dull that no great shortage of transportation will be felt along the coast, and whether there will be further advances in ocean freights, remains to be seen. However, so long as one or two agencies can name prices delivered at Boston only 15c. up from last year, and other agencies are required to pay 30c. up for what bottoms are available, it is easy to see it will be slow business for the houses that are in the latter position.

It is difficult to ascertain exactly what prices are being quoted at tide just at this time and although there is still somewhat of an accumulation on the railroad yards it is not believed any great cut is being made. It is just possible some suppliers with excess coal on demurrage are making some slight concession but under present conditions the opinion seems to be that price cutting would not increase the demand to any extent.

With the amount of vessel tonnage in port and that due it is believed the total dumpings for January will be around the million-ton mark. To the morning of Jan. 30, the Virginian Ry. had dumped 236,514 tons and the Chesapeake & Ohio Ry. 214,163 tons; the Norfolk & Western Ry. figures were not obtainable.

Recent steamer clearances have been noted as follows:

Vessel	Destination	Vessel	Destination
Corcovado[1]	Rio de Janeiro, Brazil	Galveston[1]	Santiago
Liguria[2]	Elba, Italy	Oilfield[2]	Canal Zone
Tyskland[2]	Havana, Cuba	*Edw. E. Briry[2]	Bernambuco, Brazil
Beltier[1]	Unknown	Vesuvio[2]	Unknown

[1] Loaded at Newport News. [2] Loaded at Norfolk. * Schooner.

OCEAN FREIGHTS

Market steadies down though rates are still generally higher. Sailing vessels most advantageous to Rio but these rates are also advancing rapidly. High point not reached yet.

There was a pause in the freight market during the last week and rates to Mediterranean and South American ports could have been shaded slightly. This does not apply to outward coal to Cuban and West Indian ports. These rates held firm, owing to the still further advance in sugar freights from Cuba.

A steamer was chartered to load coal at Baltimore for the River Plate at $8.88 at which figure a number of others were offered. A large steamer was also chartered for coals, from a United States port to Italy, on time charter, shippers agreeing to re-delivery United Kingdom, which makes the outward freight rate uncertain, but it is estimated at about $10.80 which rate can be shaded.

A number of additional sailing vessels were chartered, from Virginia to Rio, at $5.35, charterers paying all foreign port charges. At present it would seem preferable to ship Rio coal by sail rather than by steam, as the rates are very much lower. Sail rates on the coast, however, are advancing, and this will no doubt have an effect on offshore rates.

A steamer was chartered, from Baltimore to Guantanamo at $2.75, and another from Norfolk to Bermuda, at $3.75, and if the war continues for any length of time, rates will undoubtedly reach new high levels.

The market is hardly quotable, but approximate steamer prices on coal may be taken as follows:

To	Rate	To	Rate
Havana	**$2.75**	Guantanamo	**$3.25**
Cardenas or Sagua	3.25@3.50	Demerara	**5.50**
Cienfuegos	**3.25**	Bermuda	3.75@4.25
Port of Spain, Trinidad	3.25@3.50	Vera Cruz	3.25@3.50
St. Lucia	3.00@3.50	Tampico	3.25@3.50
St. Thomas	3.00@3.25	Rio	**9.60**
Barbados	3.25@3.50	Montevideo, Buenos Aires or La Plata	**9.60**
Kingston	**3.25**	Mediterranean	**9.60**
Curacao	**3.00**	Valparaiso	7.20@8.40
Santiago	**3.25**		

Note—Rates noted in **bold face** type are only approximate.
W. W. Battie & Co.'s Coal Trade Freight Report.

OCEAN CHARTERS

Coal charters have been reported by the "Journal of Commerce" as follows:

Vessel	Nationality	From	To	Tons	Rate
Adriatico	Italian	Baltimore	Genoa	3362	
Storfond	Norwegian	Philadelphia	Havana	2256	
Florence M. Penley		Norfolk	Rio Janeiro	927	$5.35
Hope Sherwood		Norfolk	Bermuda	522	2.50
Malcolm Baxter, Jr.		Norfolk	Boston	1479	1.00
Jacob M. Haskell		Atlantic Range	Guantanamo	1362	
Margaret Thomas		Atlantic Range	Guantanamo	1161	
Wm. E. Burnham		Atlantic Range	Guantanamo	642	
John D. Colwell		Philadelphia	Santa Isabel, P. R.	946	
Ada F. Brown		Norfolk	Rio Janeiro	1294	5.35
D. H. Rivers		Baltimore	San Juan, P.R.	963	
Lucinda Sutton		Philadelphia	Martinique	1331	
St. Gothard	British	Baltimore	W. C. Italy	1790	

Note—Steamers are indicated by **bold face** type, all others being schooners

OHIO VALLEY

PITTSBURGH

Six-year Lake coal contract closed, also one cargo for export. Regular demand slightly improved. Prediction of $1.15 for Lake coal to large shippers. Operations at 55 to 60% of capacity.

A prominent coal and coke interest has just closed a contract with one of the leading Lake shippers for about 200,000 tons of Lake coal annually for a period of six years. The price terms of the contract are not divulged, but it is understood that it is a differential above the prevailing mining rate and that the margin is a close one, in keeping with the rather depressed state of the coal industry.

The first coal export order reported in this district for some time has just been closed, involving one cargo for a foreign port, not specified, of about 6500 tons. This was for a good grade of Youghiogheny gas coal, and quality is understood to have played a large part in determining the destination of the order.

Negotiations have hardly begun yet on coal for the coming Lake shipping season, but there has been some comparing of notes, and in a well posted quarter the prediction is hazarded that the prevailing price will be about $1.15 to the large shippers for ¾-in. Pittsburgh coal. This is 20c. below the prevailing price two years ago. One year ago there was nothing like a standard price, the inquiries being far below normal and developing sharp competition in every instance.

The weather has been only moderately favorable to the development of a good retail demand in the past week, but manufacturing demand has undergone a further increase, and most of the steel mills are now working at a decidedly better rate than a month ago, consuming from 25 to 50% more coal now than in December. Railroad demand has looked up a trifle. Mining operations in the Pittsburgh district have responded to the slightly better total demand, and the mines are working at between 55 and 60% of capacity, on an average.

Prices are a trifle steadier than a week or two ago, and remain quotable about as follows: Slack, 90c.@$1; nut and slack, $1.05; nut, $1.10; mine-run, $1.15; ¾-in., $1.25; 1¼-in., $1.35, per net ton at mine, Pittsburgh district.

TOLEDO

Cold weather gives added impetus to Toledo coal trade. Prices remain unchanged.

Severe cold weather has had the effect of putting some life into the domestic situation and if it continues there will be plenty of business to keep all the local dealers busy. The steam market is not showing any great activity as many of the Toledo manufacturing plants are running light. Prices have not changed so far as the list is concerned but are not very closely held and are largely regulated by how bad the seller desires to let go and how urgent the demand of the buyer. Railroads have not found any difficulty thus far in moving supplies promptly.

COLUMBUS

Colder weather has stimulated the domestic trade slightly. Dealers are buying for immediate delivery and cancellations are less frequent. Steam trade is still dull.

The continued cold weather had resulted in a better tone to the domestic trade; buying on the part of dealers is better and orders are generally larger as their stocks are light and they must come into the market now in order to be prepared to take care of their retail business.

Retail trade has been fairly steady in both the cities and rural districts. Consumers have been compelled to replenish their supplies since the winter has been rather rigorous. Orders are usually small except in the case of public institutions and office buildings. Retail prices are ruling firm at the same level. There is still a preference being shown for Pocahontas and West Virginia varieties but Hocking lump is moving well.

Steam business continues dull and there are no immediate signs of improvement. Much attention is being given to the renewing of contracts, a large number of which expire about Apr. 1. A considerable amount of the steam tonnage at present is being purchased in the open market. One of the best features is the better demand for railroad fuel. Surpluses which railroads had collected are being gradually depleted.

Production has not been increased to any extent during the past week. The Hocking Valley is producing about 60% of normal and the same figures are reported from Cambridge, Crooksville, Jackson and other small districts. In the Pomeroy Bend district the output is about 80% of the average.

Prices in the Ohio fields are:

	Hocking Valley	Pomeroy	Kanawha
Rescreened lump	$1.50	$1.60	.....
Inch and a quarter	1.45	1.50	$1.45
Three-quarter inch	1.35	1.40	1.35
Nut	1.15	1.25	1.15
Mine-run	1.10	1.15	1.10
Nut, pea and slack	0.70	0.75	0.65
Coarse slack	0.60	0.65	0.55

CINCINNATI

The cold weather has stimulated all departments of the trade. Orders plentiful, though averaging small. Outlook much improved, and prices stiffening up.

Both domestic and steam consumers have been forced into the market in greater numbers than has been the case for some time. Almost continuous snow last week, with fairly low temperatures, has compelled the liberal use of fuel, and those who hoped to get through to spring without buying in any quantity are being forced into the market again. Industrial conditions also seem better.

Complaint is heard from some quarters that the volume of business is still much below what it ought to be, but the trade may shortly expect normal conditions, if the favorable weather continues. Judicious curtailment of production has been necessary this season and a more general observance of this will help the present situation.

CLEVELAND

Weather more favorable to the coal business, but the supply has been fully equal to the demand. No change in prices. Floods cause some uneasiness.

The weather has been cold and had a bracing effect on the local market. The retail trade was brisk and did more business than for several weeks. Last Sunday a rain storm, that lasted over Monday, began and by night the rivers and streams were almost at flood stage. Monday some of the railroads called upon local consignees to give orders for quick placing of cars because of the danger of a flood. Toward night the ice jam that was causing the trouble gave way without damage.

Receipts over Sunday were not very large, but the continued presence of consignment fuel held the market for coarse coals down. Fine coal sold at $1.65 to $1.70, and jobbers were not called upon to help move a surplus.

Reports from the Upper Lake docks indicate there will be very little early Lake coal to go forward. Duluth-Superior has close to 7,000,000 tons of coal on dock and agents there estimate the docks will carry close to 4,000,000 tons at the opening of navigation.

The market is now quotable as follows:

	Pocahontas	Youghiogheny	Bergholz	Fairmont	W. Va. No. 8
Lump	$3.60	.....	.....	.....	.....
Lump, 6 in.	.....	.....	$2.35	.....	.....
Lump, 1¼ in.	.....	.....	2.20	$1.95	.....
Lump, ¾ in.	.....	$2.35	.....	.....	.....
Lump, 4 in.	.....	2.25	2.10	1.90	$2.05
Egg	3.60	.....	.....	.....	.....
Egg, 6 in.	.....	.....	2.00	.....	.....
Mine run	2.60	2.15	1.90	1.85	1.95
Slack	.....	1.80	1.75	1.70	1.75

COKE

CONNELLSVILLE

No more coke company failures expected. Coke quiet, but not on account of Thompson failure. Production and shipments somewhat increased.

Present prospects are that there will be no more receiverships for coke companies growing out of the Thompson failure. The only coke receivership thus far is that of Tower Hill, already reported. The failure has not noticeably affected the coke market and is hardly likely to do so. While Mr. Thompson seems to have made no progress in straightening out his affairs, it looks as if there would be fewer changes in ownership than expected, because a number of the recent transactions regarded as loans turn out, with the present alignment of things, to have been sales, so that a considerable part of what has been regarded as Thompson coal acreage is really now in the possession of strong bankers. The steel industry has improved very materially, the Carnegie Steel Co., for instance, operating 32 blast furnaces against 22 three weeks ago, but among the merchant furnaces, the chief buyers of merchant coke, there is no increase in operations. Prompt furnace coke is $1.55 to $1.60 for standard grades, with some brands offered at less, and a good brand could be bought for delivery to Apr. 1 at $1.60. Foundry coke for prompt shipment is offered down to $2, with a strict guarantee of analysis, but some well known brands are still held at $2.40 or $2.50. Contract foundry coke is hardly quotable, but ranges somewhere inside these limits.

The "Courier" reports production in the Connellsville and lower Connellsville region in the week ended Jan. 23 at 214,210 tons, an increase of 7360 tons, and shipments at 212,017 tons, an increase of 7619 tons.

Buffalo—The demand for all grades of coke is light and there is no apparent prospect of improvement at present. There is prediction of something better soon, but that can hardly happen till there is new life to the iron trade. With foodstuffs very active and cotton doing well, it is generally believed that manufactures are are soon to follow. Quotations remain at what is regarded bottom figures, $4.25 for best 72-hr. Connellsville foundry and $3.30 for stock coke.

Toronto, Can.—Coke dealers have been reminded of the existence of a city bylaw to the effect that coke must be sold by measure and not by weight, which has hitherto been regarded as a dead letter. One dealer was prosecuted under this law, but released with a caution, and future offenders are to be heavily fined.

Chicago—Domestic sizes have not been in sufficient quantities to meet the demand, and prices are strong. Furnace and foundry trade shows very little activity, and there is more of this coke on hand than the market will absorb.

Prices are as follows: Byproduct, $4.60@4.95; Connellsville, $4.60@4.80; Wise County 72-hr. (select), $4.60@4.75; gas coke, $4@4.25.

THE STEEL INDUSTRY

January operations show a moderate, but encouraging, increase. The feeling generally better. Railroad buying steadily improving.

Since the steel companies were responsible for practically all of it, the January increase in pig-iron production gives a measure of the gain in steel works output. Our statistics show a total make of 1,601,421 tons of pig iron last month, against 1,515,752 tons in December, a gain of 85,669 tons or 2763 tons a day. The steel works furnaces made 1,115,944 tons in January, against 1,034,802 tons in December, a gain of 81,000 tons or about 8%.

The total number of furnaces in blast Feb. 1 was 160, against 146 on Jan. 1, the Steel Corporation contributing 10 to the increase and the independent steel companies 4. The capacity of all furnaces in blast Feb. 1 was 56,270 tons a day against 48,848 tons a day one month previous. The Steel Corporation is to put three additional furnaces in blast this week —one Lorain and two Shoenberger.

Operations in the Steel Corporation's plants are now on the basis of nearly 55% of ingot capacity. Its statement of unfilled orders as of Jan. 31 is expected to show an increase of 150,000 to 200,000 tons.

The feeling in the steel trade this week is better, and the larger companies look for a further moderate increase in output in the next six weeks.

The increased ability of the railroads to get money and its further accumulation are factors in the situation of which more is heard. Rail buying is still far from normal, but each week adds to the total.—"The Iron Age."

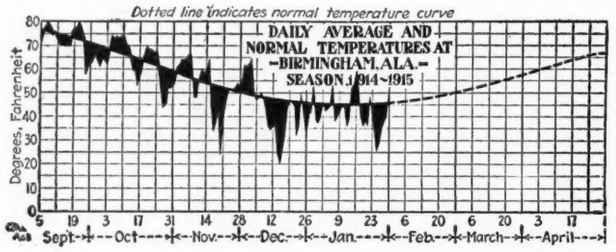
SOUTHERN

LOUISVILLE

Colder weather stimulates the market slightly but the trade is still weak.

Cold weather has resulted in a mild sort of stimulation for the domestic coal market though there has not yet been any improvement in prices or demand due to the fact that the stocks in retailers' hands are heavy. The steam coal market has shown a steady improvement with the betterment of general industrial conditions and there is said to be no steam coal on demurrage in the central part of the country.

Prices continue about as heretofore with block coal ranging up to $1.75 for the best Eastern grades, egg sizes around $1.15 to $1.25 and nut and slack 60 to 70c. for the best grades and 30 to 50c. for the lower grades, all f.o.b. mines.



MIDDLE WESTERN

INDIANAPOLIS

Continued cold weather fails to help the market because of the heavy buying in January. Falling off in orders. Domestic grades moving well. Prices generally unchanged.

The operating end of the Indiana coal industry is suffering a reaction. Consumers stocked up some time ago with the result that their recent buying has been small. The mines are on shorter schedule again, the smaller ones not making much better than three days a week and the larger ones a day more. All the mines made good time during January and most of them from about the middle of December when the real winter weather began. The railroads were then large buyers and many of the principal factories but the stocks accumulated then have not yet been entirely exhausted.

The retail department is the one bright spot, but even in this the dealers have observed an appreciable reduction in the volume of business, apparently due to a rigid economy in fuel bills among the poorer people as a result of the restricted industrial conditions. Prices at the mines are unchanged, though retail prices have been advanced three times from the summer level. Screenings are slightly easier at 75 cents.

CHICAGO

Weather conditions more favorable. Recovery in prices noted in spots. Screenings steady. Better anthracite demand.

Lower temperatures at the close of the week have made a slightly stronger undertone. The sluggishness of last week has been less pronounced, although the cold weather has not yet had much effect on the accumulation of large stocks.

Franklin and Williamson County screenings have been quoted as low as 60c., and there is a wide range of quotations prevalent on the coarser sizes. Harrisburg coals show more firmness than any other Illinois grades. The suspension of certain cement plants in the Northwest has resulted in a considerable quantity of southern Illinois screenings being thrown on the market and consequently prices have weakened.

Springfield screenings have been bettered somewhat, and the demand for domestic sizes has improved.

A wide variation of prices obtains for eastern Kentucky coals, and there is hardly a quotable price on any size.

Hocking grades have been very slow, but nevertheless shippers have held firmly to circular prices on mine shipments. Track shipments have been sold from 10c. to 15c. below list prices.

The anthracite demand which has been slowing up improved during the latter part of the week. A few cars have been accruing demurrage awaiting disposition. The supply of all sizes is ample, but prices are well maintained considering conditions.

Competition in the smokeless coal market has been keen, and while mine-run is holding steady under adverse conditions, lump and egg prices are variable. There seems to be plenty of lump but not much egg on hand and the demand for the latter is brisk.

Prevailing prices are as follows:

	Franklin Co.	Springfield	Sullivan	Clinton	Carterville
Lump	$1.50@1.75	$1.50	$1.40@1.75	$1.40@1.60	$1.50@1.75
4-in. lump	....	....	....	....	....
Steam lump	....	1.15	1.25	1.15@1.25	1.15@1.25
2½-in. lump	....	....	1.35@1.60	....	....
1¼-in. lump	....	....	1.35@1.50	....	....
Mine-run	1.15@1.25	1.0	1.10	1.10	....
Egg	1.50@1.75	....	1.35	1.35@1.50	....
No. 1 washed	....	....	....	....	1.60
No. 2 washed	....	....	....	....	1.60
6x3-in. egg	....	1.40@1.50	....	....	1.40@1.60
Nut	....	1.35	....	1.15@1.25	1.25@1.35
No. 1 nut	1.60@1.75	....	....	....	....
No. 2 nut	1.50@1.60	....	....	....	....
Screenings	0.60@0.70	0.60@0.70	0.60@0.70	0.60@0.70	0.50@0.70

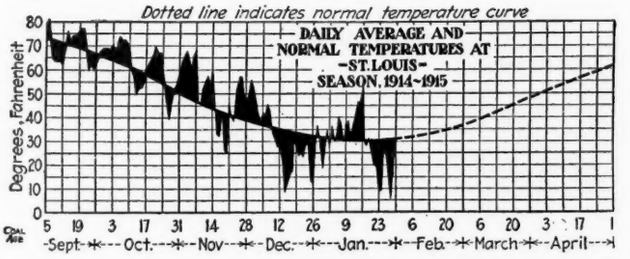
	Harrisburg	E. Kentucky	N. Riv. & Poca.	Somerset	Hocking
Lump	$1.60@1.75	$1.75@2.25	....	....	....
1¼-in. lump	....	1.50@2.00	....	....	$1.35@1.50
Lump & egg	....	....	$1.75@2.25	$1.75@2.00	....
Mine-run	1.15@1.20	....	1.25@1.40	1.10@1.25	1.15@1.25
Egg	1.50@1.75	1.25@1.75	....	....	....
No. 1 nut	1.40@1.60	....	....	....	....
No. 2 nut	1.30@1.60	....	....	....	....
Screenings	0.60@0.75	....	....	....	....

Greene County 5-in. lump, $1.50@1.75; 3-in. lump, $1.40; 5-in. egg, $1.25@1.35; 3-in. egg, $1.25@1.30; mine-run, $1.10; screenings, 60 to 70c.

ST. LOUIS

Plentiful stocks available and cold weather has failed to relieve the pressure, though better grade coals are firmer in some cases. Retail demand active but orders are small.

Though the mercury has been hovering around the zero mark, there is a striking contrast with what the market ought to be and what it really is. During the past few weeks all of the retail yards stocked up well on coal so that they were well prepared for the cold snap. As a result, there is extremely cold weather here with practically no demand for coal, and the situation is in such shape that the dealers can dictate the price at which they will buy. Continued cold weather, however, may change this situation in the next day or two, and prices will likely advance.



Some exceptionally good coals from the Williamson and Franklin County fields are selling as low as $1.25 and $1.30, while some of the other fuels from the same field are as high as $1.60 to $1.70. The operators with the higher priced coals, however, are pretty well sold up and are in a position where they can ask a fancy price, knowing that they will have but very little coal to offer on the market. The same conditions apply to the steam sizes, with the exception of washed No. 1, which is in good demand and likely to continue so. There is very little activity in the steam market, and nothing at this time to indicate that it will get any better.

In the Standard field conditions are such that few operators are realizing more than the cost of production on their coal though more cold weather will affect the Standard lump market shortly. The steam sizes are weak with every indication that they will continue so.

The local retail demand is fairly good, but retailers report that there are no large orders. The anthracite demand is light, and the same applies to smokeless. The prevailing market is:

	Williamson and Franklin Co.	Big Muddy	Mt. Olive	Standard	Sparta
2-in. lump	.....	$2.00	$1.25	....	.....
3-in. lump	.....	....	1.40	....	.....
6-in. lump	$1.35@1.65	....	1.50	$1.15@1.25	$1.25
3x6 egg	1.25@1.55	....	.....	1.00@1.10	.....
No. 1 nut	1.15@1.30	....	.....	0.90@0.95	.....
Screenings	0.65@0.70	....	.....	0.40@0.45	0.50
Mine-run	1.05@1.10	1.50	.....	0.80@0.85	.....
No. 1 washed nut	1.65@1.75	2.00	1.60	....	.....
No. 2 washed nut	1.30@1.40	....	....	....	.....
No. 3 washed nut	1.15@1.20	....	.....	....	.....
No. 4 washed nut	1.10@1.15	....	.....	....	.....
No. 5 washed nut	0.40@0.50	....	.....	....	.....

Coal Contracts Pending

Contracts listed in this department are authoritative in every respect except where the source of information is questionable, in which event it is noted. All contracts are listed promptly on receipt and only repeated when additional information becomes available or in the last issue previous to the day on which bids will be closed. Liberal remuneration will be paid for all legitimate notices of this kind sent in.

Contract No. 62—New York, N. Y.—The bids on this contract (p. 189), which provides for furnishing and delivering coal, were as follows:

SCHEDULE NO. 1, for 650 gross tons bituminous coal to the Far Rockaway disposal plant, Borough of Queens: George D. Harris & Co., $2788.50; John B. Reimer, $2925; William A. Duncan, $3048.50; A. J. & J. J. McCollum, $3217.50.

SCHEDULE NO. 2, for 280 gross tons pea coal to the Newton disposal plant, Borough of Queens: Burns Bros., $1624; John B. Reimer, $1484; J. E. Backus & Sons, $1316; Elmhurst Coal Co., $1330; Jurgen-Rathjen Co., $1307.60; A. J. & J. J. McCollum, $1489.60; Charles Hirschburger, $1372.

SCHEDULE NO. 3, for 1040 gross tons anthracite coal to the County and Borough Buildings in the Borough of Queens:

Amount	Burns Bros.	John B. Reimer	Jurgen-Rathjen Co.	A. J. & J. J. McCollum
600 tons broken[1]	$5.99	....	$5.93	$5.89
200 tons stove[1]	6.57	....	6.68	6.37
100 tons stove[2]	7.10	....	6.93	7.00
140 tons stove[3]	7.60	7.15	6.93	7.25
Totals	$6682	$1001	$6557.20	$6523

[1]Delivery at Long Island City. [2]Delivery at Flushing. [3]Delivery at Jamaica.

SCHEDULE NO. 4, for (1) 100 tons semibituminous to the Crematories of the Bureau of Street Cleaning at Far Rockaway: George D. Harris & Co., $4.29; John B. Reimer, $4.40; William A. Duncan, $4.75; (2) for 180 tons semibituminous to the Far Rockaway Aqueduct: George D. Harris & Co., $4.24; John B. Reimer, $4.50; William A. Duncan, $4.75. Total on both sections, George D. Harris & Co., $1192.20; John B. Reimer, $1250; William A. Duncan, $1330. Address Mr. Buckley, Borough Hall, Jackson and Fifth St., Long Island City, New York.

Contract No. 67—Schenectady, N. Y.—The local city government will be in the market for about 4730 tons of anthracite stove and egg coal, about the first of next month. The contract is usually closed at about $6.50 per ton. Address, Board of Contract and Supply, Franklin St., Schenectady, New York.

Contract No. 70—Baltimore, Md.—The Fidelity & Deposit Co. purchases about 2000 tons of standard mine-run soft coal annually which is usually bought a carload at a time. Address, Morris R. Pierson, purchasing agent, Baltimore, Maryland.

Contract No. 71—Monroe, Mich.—The Municipal Electric Light Plant at this place, will be in the market for 2600 tons of Smithers Creek coal some time during March. Deliveries are to extend over the next year, and the customary contracting price is $2.60 per ton. Address, Charles R. Osgood, superintendent, Municipal Electric Light Plant Co., Monroe, Michigan.

Contract No. 72—Baltimore, Md.—The H. McCormick & Co. contracts for about 100 tons of soft coal per month. The supply is usually ordered in carload lots when required. Address, H. P. McCormick, McCormick Block, Baltimore, Maryland.

Contract No. 73—Washington, D. C.—Sealed proposals will be received until 11 a.m., Feb. 15, for furnishing and delivering bituminous coal, either at Washington, D. C., or at Alexandria, Va., for the steamer on duty at Fort Washington, Md. Address, J. B. Houston, Depot Quartermaster, Washington, D. C.

Contract No. 74—Bellefontaine, Ohio—The lowest bid received for furnishing a six-months' supply of coal for the local water works was from the W. H. Warner Co., at $1.75 per ton f.o.b. Bellefontaine. The Sunday Creek Coal Co. at present, has the contract, and offer to renew the same at $1.85 per ton. Address Director of Public Service, Bellefontaine, Ohio.

Contract No. 75—Ottawa—The Canadian Department of Public Works calls for tenders addressed to R. C. Desrochers, Secretary, to be received up to March 1st for supply of best quality steam coal to be delivered in quantities, and at places specified. Address, R. C. Desrochers, Secy., Department of Public Works, Ottawa, Canada.

Contract No. 76—Baltimore, Md.—The Emmerson Hotel Co. purchases about 300 tons of standard mine-run coal per month in the spot market. At present there is no existing contract, and bids for furnishing these requirements on a contract might be considered. Address, Wm. H. Parker, purchasing agent, Emerson Hotel Co., Calvert and Baltimore Sts., Baltimore, Maryland.

Contract No. 77—Rochester, Ind.—The Rochester Electric Light, Heat & Power Co. at this point will be in the market for 7000 tons of Indiana mine-run coal on Mar. 1. The contract is to run over one year and it is usually closed at $2.10 per ton. Address, Rochester Electric Light, Heat & Power Co., Rochester, Indiana.

Contract No. 78—Detroit, Minn.—The Municipal Electric Light Plant will be in the market for 1800 tons of Youghiogheny dock-run coal on Mar. 1. This coal laid down at Detroit usually costs $5 per ton and deliveries are to be made over the next year. Address, E. J. Bestick, City Clerk, Detroit, Michigan.

Contract No. 79—Boston, Mass.—The following are the bids received by the United States Navy, for furnishing 5000 tons of navy steaming coal, to be delivered at the Navy Yard, Boston:

5000 TONS—Edward M. Alden Co., New River Georges Creek coal, $3.73, Ralphton Quemahoning, $3.65; Davrow-Mann Co., New River coal, $3.57; Archibald McNeil & Sons Co., Navy New River coal, $3.68; Pocahontas Fuel Co., Pocahontas coal, $3.80; White Oak Coal Co., New River coal, $3.60.

6000 TONS—Bader Coal Co., Pocahontas mine-run, $3.45; Davrow-Mann Co., New River coal, $3.57; J. H. Weaver & Co., Colver coal, $3.40.

3305 TONS—Chesapeake & Ohio Coal Co., half navy standard, one-half trade, $3.62.

5500 TONS—Northern Coal Co., New River coal, $3.55; (bid modified by telegram, $3.60).

5600 TONS—Maryland Coal & Coke Co., standard New River coal, $3.45.

Address, Samuel McGowan, paymaster-general of the Navy, Washington, D. C.

Contract No. 80—Bismarck, N. D.—Bids will be received by the Board of Public Works until 8 p.m., Feb. 8, for supplying about 300 tons of best lump lignite coal to the public schools during the ensuing year. The coal will be subject to state analysis. For further information address R. Penwarden, Clk. of the board, Bismarck, North Dakota.

Contract No. 81—Philadelphia, Penn.—Sealed proposals will be received until noon, Feb. 17, for furnishing and delivering about 29,000 tons of bituminous coal to the floating plant employed in the Philadelphia Engineer District of the United States Government during the period beginning Mar. 1, 1915, and ending June 30, 1916. Address, Col. Geo. A. Zinn, 815 Witherspoon Building, Philadelphia, Pennsylvania.

Contract No. 82—Winnipeg, Man., Can.—Tenders will be received by the Commissioners of the District up to noon, Feb. 22, for furnishing the supply of steam coal required during the year 1915 The quantity is estimated at from 6000 to 12,000 tons. Address S. H. Reynolds, Chairman of Commissioners, 901 Boyd Building, Winnipeg.

Contract No. 83—Baltimore, Md.—The Chamber of Commerce Building purchases an annual supply of from 475 to 500 tons of superior grades Georges Creek coal. The contract calls for the delivery of about one car per month during the summer season, and one and one-half cars during the winter. Address, John T. Davies, purchasing agent, room 214, Chamber of Commerce Bldg., Baltimore, Maryland, for further information.

CONTRACTS LET

Contract No. 8—Portland, Ore.—Bids on this contract (Vol. 6, p. 814) which provide for furnishing 5000 tons of coal, for use on the Dalles-Celilo Canal, were as follows, all prices f.o.b. mine: Roslyn Fuel Co. (13,650 B.t.u.) $2.70; Gunn-Quealy Coal Co. (13,000 B.t.u.) $1.62; Wyoming Coal Co. (13,500 B.t.u.) 87½c.; Wellington, Coma Agency (12,050 B.t.u.) $3.50; Kemmerer Coal Co. (13,900 B.t.u.) $1.79; A. L. Stephens (13,000 B..u.) $3; A. L. Stephens (12,800 B.t.u.) $2.50. The awards were as follows: Roslyn Fuel Co. for 500 tons, and A. L. Stephens for 1500 tons. Owing to the more rapid completion of the canal than anticipated the requirements do not exceed 2000 tons. Address Major Jay J. Morrow, Corps of Engineers, U. S. A., U. S. Engineer Office, 802 Couch Bldg., Portland, Oregon.

Contract No. 61—Erie, Penn.—This contract (p. 189), which provides for furnishing the best Pittsburgh ¾-in. lump coal to the local garbage disposal plant, has been let to the Burnwell Coal Co., at $2.30 f.o.b. the Garbage Plant Siding, Belle Valley, Penn. Address, Frank E. Pellow, Supt. of Parks and Public Property, Erie, Pennsylvania.

Contract No. 63—Lorain, Ohio—This contract (p. 189), which provides for furnishing 3500 tons of coal for the water department, has been awarded to the West Virginia & Ohio Coal & Coke Co., Cleveland, Ohio, at $1.87 per ton f.o.b. Lorain for Goshen mine run and $1.55 for slack coal. Address, L. B. Johnston, Clerk, Board of Public Service, Lorain, Ohio.

Contract No. 66—Guantanamo Bay, Cuba—The bids on this contract (p. 231), which provide for furnishing and delivering, or either, or both, 5000 tons of coal to the United States Government at Guantanamo Bay, Cuba, were: Wm. C. Atwater & Co. (Pocahontas coal), $6.80; Berwind-White Coal Mining Co., 4600 tons at $5.90, and 1100 tons at $5.25; Caster-Curren & Bullitt (Pocahontas coal), $6.80; H. N. Hartwell & Sons (smokeless fuel), $6.74; Maryland Coal & Coke Co., 2300 tons at $5.80; Smokeless Fuel Co., $6.84; Willard Bros., 684 tons at $6; Pocahontas Fuel Co., 5000 tons at $6.95, and the same (by sailing vessel), $5.60. The awards were: W. A. Blake & Co., transportation on 1000 tons, $2500; Crowell & Thurlow, transportation on 1900 tons at $5700; Berwind-White Coal Mining Co., for furnishing and transporting 1100 tons at $5775.

CONTRACT NOTES

The United States Naval Department have asked for bids for the transportation of one to six cargoes of coal amounting to 5000 to 8000 tons each, from Atlantic Coast points to San Diego, Calif. and, or to, Tiburon, Calif. The carriers must be ready to load at any time upon demand between Feb. 20 and Apr. 20.

The United States Naval Department has asked for bids for the transportation of one cargo of coal of 5000 to 8000 tons from the Atlantic Seaboard to San Diego, Calif., or to Tiburon, Calif. Loading is to be made at any time on request between Feb. 15 and Mar. 15.

PRODUCTION AND TRANSPORTATION STATISTICS

SOUTHWESTERN TONNAGE

The following is a comparative statement of the Southwestern tonnage for September and the preceding two months of the years 1913 and 1914:

	July		August		September	
State	1913	1914	1913	1914	1913	1914
Missouri...	198,723	177,093	178,949	201,992	250,763	233,195
Kansas.....	465,761	513,312	451,968	453,675	474,237	569,114
Arkansas...	163,185	117,016	178,904	157,803	201,782	160,233
Oklahoma ..	272,124	234,638	289,949	244,103	297,213	254,973
Totals...	1,099,793	1,042,069	1,099,770	1,057,573	1,223,995	1,217,515

LAKE MOVEMENT

The following is a summary of the fuel shipments by the Lakes for the past 10 years:

Year	Pittsburgh	Ohio	Virginia	Total Bit.	Anthracite
1905.....	7,443,883	2,062,692	2,109,262	11,615,837	2,785,362
1906.....	9,237,272	2,560,906	2,743,732	14,591,910	2,681,808
1907.....	10,549,995	4,074,296	3,420,941	18,037,232	3,449,695
1908.....	8,700,000	3,600,000	3,450,000	15,750,000	3,538,098
1909.....	8,687,395	3,002,815	3,874,570	15,564,690	3,052,706
1910.....	11,911,900	4,297,300	6,629,500	22,838,700	3,639,368
1911.....	10,611,941	4,019,544	7,151,200	21,782,685	3,917,419
1912.....	11,300,000	4,676,000	7,360,000	23,335,000	4,204,741
1913.....	13,415,473	6,176,624	8,736,586	28,328,683	5,033,696
1914.....	11,195,000	1,363,000	9,106,000	22,996,000	4,285,228

NORFOLK & WESTERN RY.

The following is a statement of coal handled by the N. & W. Ry. during December and the past four months in short tons:

	September	October	November	December
Pocahontas Field.....	1,390,531	1,021,699	837,577	798,182
Tug River District.....	295,332	270,651	253,975	227,944
Thacker District.....	295,776	264,528	235,080	227,938
Kenova District.....	110,158	112,455	90,772	90,030
Clinch Valley District....	158,393	84,530	237,831	135,362
Other N. & W. Territory	4,781	4,860	3,849	1,686
Total N. & W. Fields..	2,254,971	1,758,723	1,659,084	1,481,142
Williamson & Pond Creek R.R.....	85,053	70,338	62,505	62,271
All other railroads.....	169,892	168,778	131,269	97,752
Grand total.....	2,509,916	1,997,839	1,852,858	1,641,165

BITUMINOUS COAL MOVEMENT

The following is a summary of the movement of coal and coke over 13 principal railroads during November and the first eleven months of the last two years, in short tons:

	November		11 Months	
Anthracite	1913	1914	1913	1914
Baltimore & Ohio[1].....	171,714	126,769	1,398,652	1,245,323
Chesapeake & Ohio[1].....	1,225	1,209	15,864	15,646
Erie[2].....	732,726	696,812	8,016,552	8,487,000
Pennsylvania[1 3].....	987,487	1,017,942	9,699,210	10,223,221
Virginian[2 1].....	50	142	959	484
Total 5 roads.....	1,893,202	1,842,874	19,131,237	19,971,674
Bituminous				
Baltimore & Ohio[1].....	3,080,093	2,452,786	33,732,240	30,186,640
Buffalo, Roch. & P.[1 2]...	869,023	640,508	8,907,011	7,376,316
Buffalo & Susq.[1 2].....	138,315	97,105	1,645,656	1,068,453
Chesapeake & Ohio[1].....	1,528,761	1,555,489	15,716,866	19,162,434
Erie[2].....	20,437	3,998	340,201	71,897
Hunt. & Br'd T. Mt.[1 2]..	107,016	80,351	1,242,310	939,439
New York Central[3].....	755,397	673,131	8,414,117	7,363,050
Norfolk & Western[1 2]...	2,026,798	1,852,858	22,056,646	23,830,804
Pennsylvania[1 3].....	4,509,375	3,667,385	47,171,538	44,013,552
Pitts. & Lake Erie[1 2]....	1,101,622	638,704	11,914,029	10,078,546
Pitts. Shaw. & North[1 2].	227,820	220,583	2,535,163	2,125,073
Virginian[1 2].....	421,971	281,499	4,190,394	3,678,295
Western Maryland.....	246,793	251,588	3,073,864	2,810,817
Total 13 roads.....	15,033,421	12,415,985	160,940,035	152,705,316
Coke				
Baltimore & Ohio[1].....	343,387	185,466	4,340,798	2,969,787
Buffalo, Roch. & P.[1 2]...	27,509	30,253	472,671	269,443
Buffalo & Susq.[1 2].....	22,621	48,812	278,124	398,485
Chesapeake & Ohio[1].....	28,535	11,304	328,456	287,425
New York Central[3].....	.....	.....	36,207	.....
Norfolk & Western[1 2]...	117,807	74,468	1,413,079	945,536
Pennsylvania[1 3].....	999,500	602,573	13,011,863	8,926,580
Pitts. & Lake Erie[1 2]....	488,674	281,481	6,239,226	4,542,133
Pitts. Shaw. & North[1 2].	.....	.....	9,383	.....
Western Maryland.....	4,430	2,503	68,543	56,988
Total 10 roads.....	2,032,463	1,236,860	26,198,350	18,396,377

Total Coal and Coke 13 Roads	1913	1914
January.....	19,314,523	18,157,998
February.....	17,594,079	15,446,830
March.....	17,672,305	20,233,213
April.....	16,882,326	15,497,444
May.....	19,015,721	16,523,385
June.....	18,610,757	16,984,476
July.....	18,736,979	17,589,427
August.....	19,757,104	18,740,453
September.....	19,080,318	18,601,926
October.....	20,646,425	17,802,496
November.....	18,959,086	15,495,719
Total, 11 months	206,269,623	191,073,367

[1] Includes coal received from connecting lines.
[2] Includes company's coal.
[3] Does not include company's coal hauled free.

Note:—The Southern Railway hauled 359,229 short tons of bituminous coal during October, 1914, and 3,324,703 short tons during the ten months ending Oct. 31, 1914.

FOREIGN MARKETS

GREAT BRITAIN

Severe shortage developing because of the scarcity of men. High ocean freights have caused a slowing up in exports.

Jan. 22—Firmer conditions are in evidence as a result of an improved demand. The tonnage position is much better and sellers are looking forward to an active trade for some time. Quotations are approximately as follows:

Best Welsh steam.....	$5.04	Best Monmouthshires....	$4.26@4.32
Best seconds.....	4.56@4.68	Seconds.....	4.20@4.32
Seconds.....	4.32@4.44	Best Cardiff smalls.....	3.24@3.36
Best dry coals.....	4.44@4.56	Cargo smalls.....	2.52@2.82

The prices for Cardiff coals are f.o.b. Cardiff, Penarth or Barry, while those for Monmouthshire descriptions are f.o.b. Newport, both net, exclusive of wharfage.

Freights—The demand for tonnage is not so great and chartering is slow. Tonnage, however, is still scarce. Rates are approximately as follows:

Gibraltar.....	$5.40	Naples.....	$6.96	Las Palmas.....	$6.00
Malta.....	5.76	Venice, Ancona...	9.00	St. Vincent.....	6.24
Marseille.....	5.79	Alexandria.....	7.44	Rio Janeiro.....	7.08
Algiers.....	5.52	Port Said.....	7.44	Monte Video.....	6.24
Genoa.....	6.96			River Plate.....	6.48